CHEMICAL ENGINEERING
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The 3R's in Modern Version

LEAST ORTHODOX of the many letters Prof. Erwin Schell has sent his M.I.T. alumni over the years is the one now before us. It deals with the 3R's, to be sure, but this time they stand for Rest, Recuperation and Recreation. He quotes his distinguished president, Dr. Compton, who holds that in modern life Recuperation and Recreation are no longer privileges but clear Responsibilities. He goes back to the Mosaic Law of 3000 B.C. to prove that Rhythm is one of the great Realities of life, that Rest must be part of the Recurring cycles of all human activity. Nor does he overlook the 300-year-old wisdom of our ancient friend, Izaak Walton, who in "The Compleat Angler," said: "I have found it to be a real truth that the very sitting by the river's side is not only the quietest and fittest place for contemplation but . . . that when God intended to reveal any future events or high notions to his prophets, he then carried them either to the deserts, or the seashore (or the mountains?), that having so separated them from amidst the press of business and people, and the cares of the world, he might settle their minds in a quiet Repose, and make them fit for Revelation." Remember this if you are looking for a good excuse to go fishing!

We find it difficult to quarrel with all this erudite philosophy—especially in these mad-dog days of early August. We have always been envious of our academic friends and their long summer holidays. We have often wished that ours was the kind of business that could be shut down **in toto** for even a couple of weeks so that we might avoid limping along with inadequate staff and heavier work during the absence of key associates. But somehow the job gets done and perhaps the Rest is all the sweeter—if and when we finally get it.

Yet we would like to believe that all of us have something more than self interest in mind when we consider the vacation schedules in our various companies, departments and divisions. For that reason we are pleased to see such men as Schell and Compton urging these principles as a cardinal part of modern business administration. The Re-charging of the human battery, the Re-filling of the Reservoir of energy and enthusiasm, are necessary operations that engineers, of all people, should recognize and practice. Men, like machines, can wear out as well as Rust out. But both can do more and better work with proper scheduling and maintenance.

A few years ago the average factory worker took his vacation in the form of lay-offs or periods of unemployment between jobs. Today vacations with pay are provided by practically all progressive employers in our chemical industries. This has added some complications from management's standpoint for it is often difficult to follow the old practice of staggering vacations in accordance with employee preferences and departmental efficiency. For this reason more and more companies are going in for mass vacations. When practicable they offer a solution for summer slowdowns and often provide opportunity for stocktaking as well as repairs and retooling.

But finally, let us not forget that our greatest Resource is the manpower of our professions and industries. Much of our leadership is coming from men in their dangerous forties and frightening fifties. They have come up through trying times and must still face difficult problems. Let's make sure they heed the rather brutal but effective advice once offered our favorite professor: "Don't forget, Schell, you are much more valuable alive than dead!"

Sosa Texcoco

The Establishment Fits the Clime

Mexico's newest and biggest alkali plant takes its cue from mother nature. Natural resources and climate shape its process, looks and design. For example . . .



. . . Sunny skies coax most equipment outdoors, give plant a refinery look. See surface piping, outdoor boiler.

Roger Williams, Jr.
Assistant Editor
Chemical Engineering

HARD ON the shores of Lake Texcoco in Mexico, a new soda ash and caustic industry has been born. The opening of the new Sosa Texcoco, S. A., plant heralded the birth. Designed and constructed by Chemical Construction Corp., the $2,500,000 plant will turn out 100 tons a day of soda ash, of which part will be used to produce 30 tons per day of 50 percent caustic. The unit will supply about 30 percent of Mexico's requirements of these basic chemicals, the caustic being used primarily by Mexico's soap industry.

The process used and the layout and design have been profoundly influenced by local conditions. Availability of natural brine; the hot, dry climate; and the jelly-like consistency of the sub-soil have all had their effect. In brief, the soda ash process consists of separating natural sodium chloride and sodium carbonate by conversion of the carbonate to bicarbonate, with subsequent calcining of the bicarbonate back to soda ash. Caustic is produced by reacting soda ash and slaked lime.

Actual plant location is the town of Ecatepec de Morelos, about 20 miles from Mexico City. This town used to be the old Aztec city called Ecatl-Tepec whose religious symbol consisted of the head of the God of the Wind (Ecatl) crowning a very steep or rugged hill (Tepec). This symbol is now the trademark of Sosa Texcoco.

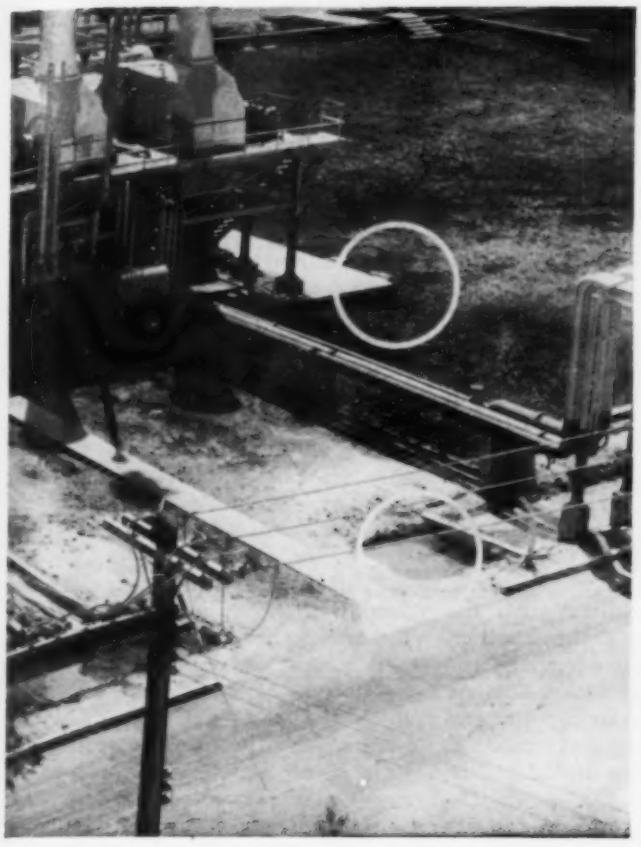
Basis for the plant is the salt deposit of Lake Texcoco, partially uncovered as the lake's level has been lowered. Back in the 1600's work began to drain Lake Texcoco, to provide land for expanding Mexico City. By completion of the job in 1900, the water level had dropped 25 ft. and the lake area was reduced to one-tenth of its original size.

The decrease in lake size left a large area of uncovered land which could not be used for agricultural purposes because of its salt contents. To make the land usable for crops, the Mexican Government took the first step in the chain of events leading toward soda ash and caustic. This was the decision to wash the salt-impregnated top soil with fresh water to make it crop-bearing.

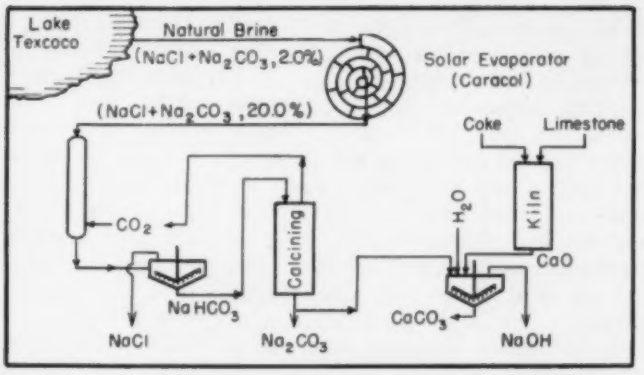
Next step was the waste disposal of the weak brine formed in the washing process. Because of the hot, dry nature of the climate the conclusion was to build a solar evaporator. The solar evaporator, called a caracol, is huge, covering 2,000 acres. This is roughly the size of Central Park in New York City. Built as an inward spiral, the caracol is sectioned, with liquid flow controlled by weirs. Operation is continuous and more than 10,000,000 gpd. are evaporated from the caracol. The concentrated brine at the center of the caracol is pumped into a canal in which it flows the two miles to the alkali plant by gravity.

Although brine from the land reclaiming project is the primary alkali raw material today, there are large deposits of salt underground which may eventually become the major raw material. Located only 50-60 ft. below ground level, geologists estimate the deposit at over 100,000,000 tons. Current plans are to use some of this deposit by means of wells, adding the brine at the proper point in the caracol.

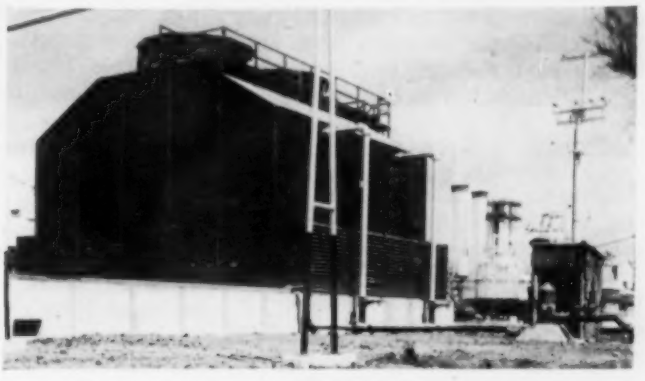
Brine entering the caracol from the government's washing project runs from 1.0 to 2.0 percent salts. At the center of the caracol this has in-



. . . **Soggy subsoil** necessitates "floating slab" foundations. Canals moisten sun-baked topsoil, prevent cracking.



. . . **Natural brine** is raw material. Soda ash is separated from salt, reacted with limestone to form caustic.



. . . **Hot, dry atmosphere** warrants solar evaporation of brine (dia.), tower-cooling of well water (photo).

creased to about 20 percent. The brine entering the plant averages about 180 g. per liter sodium chloride, 114 g. per 1. sodium carbonate, and 7½ g. per 1. sodium bicarbonate, with minor quantities of other salts.

Carbonation

First step in the process of soda ash manufacture is the separation of the natural sodium carbonate from sodium chloride. This is done by carbonating and hydrolizing the carbonate to the less soluble bicarbonate.

Brine entering the plant flows first to a sump, 20 ft. in diameter. From this sump it is pumped to two 190,000-gal. storage tanks. From these tanks the brine is pumped with self-priming pumps through spiral preheaters where it is heated to about 50 deg. C. with steam. The preheated brine is then fed into the top of four carbonating towers. Preheating is used, among other things, because the reaction

$$Na_2CO_3 + CO_2 + H_2O \rightarrow 2NaHCO_3$$

is aided by high temperatures.

The carbonating towers are plate type, 6 ft. in diameter and 100 ft. high. Unreacted carbon dioxide and inert gases are vented from the top of the towers. There are cooling coils in the lower section of the towers to precipitate the sodium bicarbonate, which is less soluble at lower temperatures.

The slurry of bicarbonate solids and sodium chloride brine from the carbonating towers is pumped first to a thickener. This is of the standard Dorr type, 40 ft. in diameter and 10 ft. high. Overflow brine is pumped out into evaporating ponds, outside the plant, from which salt will eventually be recovered and marketed. The thickened slurry then passes to a second thickener-type unit where it is washed with water. This unit is 30 ft. in diam. and 10 ft. high. The washed slurry is then pumped to the centrifuges.

Centrifuges

There are eight centrifuges, all of the suspended basket type, built by Tolhurst. To prevent settling of the slurry, and consequent plugging of the centrifuge feed line, the slurry is fed from a looped system. The loop is built around a magma tank, an agitated vessel, and slurry is pumped continuously from this tank, through the feed line, and back to the tank. Centrifuge feed is drawn off as needed for the batch centrifuge cycle.

Dryers

From the centrifuges, the solid bicarbonate cake is conveyed by belt conveyors and bucket elevators to the top of the bicarbonate dryers. These are two Herreshoff furnaces, 16 ft. in diam., and contain eight hearths. They are muffle type in order to recover carbon dioxide given off as the bicarbonate reverts to the carbonate, soda ash. Heat is supplied by external oil-fired furnaces, the products of combustion being passed through the stainless steel muffles and then to the stack. Solids temperature in the dryers is maintained at 250-300 deg. C.

Soda ash product from the dryer furnaces still contains traces of bicarbonate, organic impurities, and is not of proper density. To remedy these faults, the crude soda ash is calcined. The two calcining furnaces are direct-fired Herreshoff's, 16 ft. in diam., with six hearths. Oil fired, they operate at temperatures above 500 deg. C. The white, dense soda ash from

the calciners is then conveyed to two storage silos. These concrete silos hold 450 tons each.

From the silos, screw conveyors move the soda ash to a distributor hopper in the packaging and shipping building. From this hopper soda ash can be loaded directly into railroad cars for bulk shipment, to a bagging machine for packaging, or to a dissolving unit to supply the caustic plant.

In the dissolving plant, soda ash is automatically weighed into an agitated dissolver, maintaining a constant composition, and the solution is continuously pumped from the dissolver to the lime slaker. Water sources for the dissolver are wash liquors from the caustic sludge washing system and fresh makeup water.

Lime Kilns

Lime for the slaker is produced in two 11 ft. diam., 40 ft. high, vertical, intermittent-feed lime kilns. These units sit on a 20 ft. high platform to facilitate solids removal. Limestone, received by railroad, is now being manually broken up, although mechanical crushing equipment will be installed. Coke is also received by rail. Limestone and coke are charged to the kilns by a skip hoist, charging hopper, and sealing bell. A portable oil burner is used to start the kilns.

Burned lime from the kilns is belt conveyed to a crusher for sizing and then to indoor storage. Outdoor storage is also available. From storage the lime is automatically weighed and conveyed to the slaker.

Caustic Reaction

In the lime slaker, soda ash solution and lime meet, and inert impurities are removed. The unit, about 10 ft. in diam. and 5½ ft. deep, consists of a mixing chamber and a raking system which removes undissolved inerts, such as unburned limestone.

Liquid overflow from the slaker then goes to the caustifying tanks. These are agitated vessels, 10 ft. diam. and 8 ft. high. There are three of them in series. Operation is by overflow from one to the next. Direct steam addition provides the heat necessary for the reaction.

$$Na_2CO_3 + Ca(OH)_2 \rightarrow 2NaOH + CaCO_3$$

Exit liquor from the three tanks is about 10 percent caustic.

Resultant slurry from the caustifying tanks is pumped to a Dorr thickener, 40 ft. in diam. and 10 ft. high. The clear 10 percent caustic liquor from the top of the thickener is pumped to two 55,000-gal. storage tanks.

Sludge from the thickener still contains valuable caustic soda and is therefore washed. It passes through three additional thickener-type vessels countercurrent to fresh wash water. The final sludge is then sent to a sluicing tank prior to disposal. Wash liquors from this system are fed to the slaker.

The 10 percent caustic solution is concentrated in a double-effect Swenson evaporator system. Referred to caustic flow, the first effect is cast iron and the second is nickel clad for corrosion resistance. These evaporators have liquor circulation around the tubes and are 9 ft. in diameter at the top.

The 50 percent caustic from the evaporators then goes to a bell settler. By means of a chain scraping the conical bottom of the vessel, salts are settled to the bottom of the unit and removed. Clear 50 percent caustic is removed from the top of the settler, and pumped to four 55,000-gal. storage tanks. From these tanks it can be loaded into trucks or tank cars.

Carbon Dioxide

In the soda ash plant, carbon dioxide is required for the carbonation towers, and is produced in the dryers. This means a constant circulation. But makeup is required, and it comes from the lime kiln off-gases. Both the dryer and lime kiln off-gases receive identical treatment. They are passed first through filters to remove carried-over solids, then through water scrubbers for final solids removal and cooling. An exhauster following the scrubbers sends the carbon dioxide to a gas holder. From the holder the gas flows to a set of four compressors. These compressors are driven by high pressure (250 psig.) steam and exhaust at 20 psig. The lower pressure steam is used for heating incoming brine and for steam addition to the caustification tanks. The compressors are rated at 650 cfm. inlet and 60 psia. discharge.

One of the most interesting things about Sosa Texcoco is the series of design problems which faced the engineers. Water is found only three feet below ground level and the depth to bed rock is such that the equipment could not be supported on piles. Furthermore, the consistency of the sub-soil is jelly-like. If the ground is allowed to dry out, it cracks badly.

These geological facts made equipment foundation a real problem. The final result was to float all equipment on concrete mats. By a series of canals, extending all through the plant, the ground is kept moist and hence from cracking. Vibrations from passing railroad trains shake equipment due to the subsoil consistency, but this has been adequately covered by design. The canals used fulfill the additional use of sewerage for process water waste.

In general the plant has been designed around refinery techniques. As much as possible of the equipment is installed outdoors, since the climate of the area is hot and dry. Piping is laid at ground level, and elevated only for road crossings. The plant layout is longitudinal, with the manufacturing plant across the road from the service facilities.

Plant water supply is from three deep wells, fresh water being found 100-300 ft. below ground level. Deep well pumps send water first to a cooling tower. Although the well water is 25 deg. C., the air is so dry that cooling with the tower is worthwhile. Exit water from the tower runs 15 deg. C. Another reason for the tower is the presence of carbon dioxide in the well water. Removal in the cooling tower provides corrosion protection to some degree. No water in the plant is recirculated.

At the bottom of the cooling tower there is a reservoir of 250,000-gal. capacity, to provide a reserve for fire protection. A gasoline driven pump is situated at the reservoir as an auxiliary pump in case of fire.

Steam Plant

Steam is produced in two 40,000 pph. Babcock and Wilcox integral furnace type boilers. They are oil fired and produce 250 psig. saturated steam. All auxiliaries are steam driven. Condensate is recovered, deaerated, and reused. Feed water treatment consists of filters, a hot process, lime-soda softener, and direct phosphate addition to the boiler drums. Oil is stored in two 100,000-gal. tanks.

Electric power is purchased, although the plant design is such that a generating system can readily be installed. The heat balance of the plant will be aided by putting in generating equipment.

Grateful acknowledgement is made to F. J. Bartholomew and John Salviani, Chemical Construction Corp., for their assistance and cooperation in the preparation of this article, to Dr. Antonio Madinavieta for its revision, and to Pablo Macedo, Sosa Texcoco, S. A., for permission to publish it.

Solvent Extraction of Vegetable Oils

Soybean winnings are being parlayed into a big stake in cottonseed, other seeds, fish meal.

C. W. Bilbe
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

PROCESSING of vegetable oils is an industry long established in the United States. But the extraction of vegetable oils by modern chemical methods is relatively new. In the early days there were scattered experimental plants and a few commercial batch operations. It was little more than two decades ago, however, that the first continuous extraction plant was brought here from Germany.

German processes have profoundly influenced our technology. Some U. S. manufacturers still follow quite closely the German philosophy of design. In the main, both the German plants and their American counterparts have been successful, evidencing a long background of actual operating experience. But in some cases there has been a noticeable lack of the mechanical excellence, refinement and utility that characterize American-built machinery.

Soybean Supremacy

Solvent extraction has helped the soybean industry to capture first place in our vegetable-oil production. In little more than 20 years solvent extraction has made great strides in the soybean industry. Today enough extraction capacity is installed to handle about 30 percent of the annual production of soybeans processed for oil.

Extension of solvent extraction to the processing of oil-bearing materials other than soybeans is still in its infancy. Both machinery manufacturers and the oil processors themselves have much to learn. To benefit fully from the replacement of the older mechanical methods by solvent extraction, major modifications will have to be made. To chemical engineers and makers of machinery, this will mean further simplification of equipment to lower operating costs and reduce labor requirements. To oil processors, it will mean an entirely new conception of process control.

A unique application has been found for the continuous solvent-extraction process developed by Allis-Chalmers. The process will be used to extract fish oil from full-fat herring meal. The new unit, first in the world for this purpose, will be erected at Reykjavik, Iceland, by Kveldulfur, Ltd., which operates a herring reducing plant there. The process will step up Kveldulfur's production of herring oils. The oils go into margarine for Europe.

Progress is being made in the adaptation of solvent extraction to the processing of such materials as corn germ and flaxseed expeller cake. A new method, reported to be in service, is the use of centrifugal machinery for the processing of high-oil-content seeds such as castor beans. This looks like an interesting approach, although the economic picture is not yet clear. When it comes to the extraction of oil from cottonseed, however, the first hurdle is passed and practical industrial application has been demonstrated.

Within the past year or year-and-a-half at least four big solvent-extraction plants have started commercial production of oil from cottonseed. This is significant, particularly when coupled with the fact that only two years ago cottonseed oil lost top place to soybean oil for the first time in the history of the vegetable-oil industry. But the cottonseed-oil producers are up against a far more difficult control problem than the soybean-oil people. For inherent in cottonseed processing are variables greater both in number and in magnitude. With these, the makers of soybean oil do not have to contend. On the other hand, the cottonseed industry is years behind the soybean industry in the appreciation of the necessity for accurate process control, so essential to the successful working of a chemical plant. There is this further necessity of the cottonseed industry to be met: without defeating their objective of simplicity, equipment manufacturers will have to develop machinery of increased flexibility.

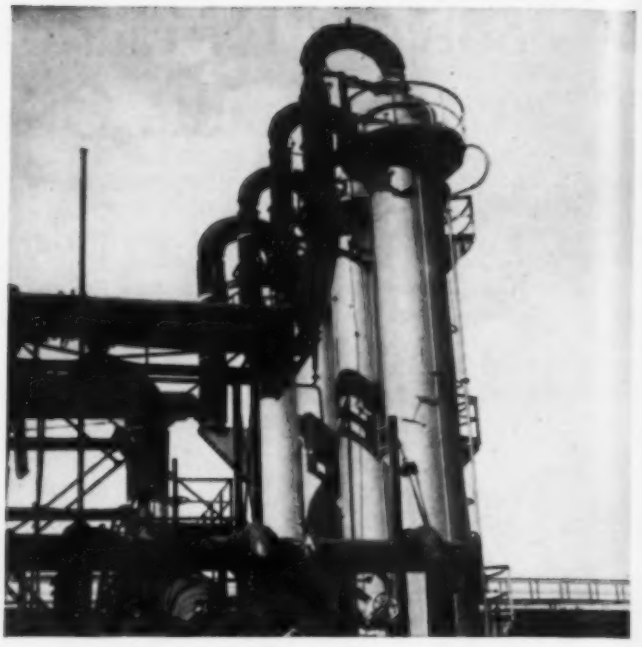
In the past most cotton-oil mills in this country have operated during short seasons. Between seasons, workers drifted into other jobs. When fall came and the mills started up again, most workers, with the exception of key men, were new. Keeping a dear school as always, experience has taught that this just will not work in a plant with a highly technical chemical process. Operators of solvent-extraction plants in the cotton-oil industry will have to face this fact: they will have to provide year-round work for their help. They are also going to need people of higher caliber than they employed when they ran their old hydraulic mills. This applies both to their supervisors and their operating people.

Multiple Crop Processing

Plants of the future will process more than one crop. Soybeans, for example, are coming into greater prominence in cotton-growing areas. For existing plants, these soybeans will supplement other raw materials, permitting year-round operation. This provides a simple solution. But the economic problems of storage and marketing will have to be licked. Not too far in the future now are such other fill-in crops as peanuts and sunflower seed. The technical problems they present are by no means insurmountable.

When considering over-all plant flexibility, we must not overlook this fact: some of the oil seeds processed in this country have not yet been continuously extracted by solvent in one step—at least not on a successful commercial basis. Copra, palm nuts and tung nuts are examples. But processing of these materials in two steps is relatively simple. A light mechanical expression followed by solvent extraction presents no great mechanical or operating difficulties. From the cost standpoint, however, the picture is not so bright. If we assume that there will be at least a partial return of prices to the levels of the mid-Thirties, without a corresponding decline in labor costs, we can expect some very sharp cuts in unit-process costs before the industry can compete with foreign imports. Both machinery manufacturers and oil-seed processors have a long way to go in this direction. And the time may be shorter than we think.





THEIR PROBLEMS. In damaged plants or new ones (left) construction is hampered by materials shortages, dearth of technical personnel. In producing plants (right) shortages of raw materials are the hurdle.

Czech Chemical Comeback

E. Fisher
McGraw-Hill World News
Prague, Czechoslovakia

THE COUP D'ETAT last March brought 90 percent of Czechoslovak chemical industry under government control. Now the State's arm encircles all private firms employing more than 50 people. Manufacturers of paints and enamels, plastics, textile and leather working accessories, and commercial adhesives fall in the new group. Completely nationalized, regardless of number of employees, are makers of pharmaceuticals, soap, cosmetics, compressed gases and photographic chemicals.

Before that, 72 percent of the industry—45 concerns employing 21,000 persons were nationalized. Included were plants producing all synthetic motor fuels and oils, rubber and tires, basic inorganic and organic chemicals, fertilizers and most phamaceuticals.

Very soon the State will set up about 80 concerns for import and export of different branches of industry. In the chemical field, Czech-Polish cooperation seems advanced enough so that one country may buy and sell on the world market on behalf of both. They are coordinating plants and research, exchanging technical personnel and students.

Czech statesmen now run a chemical industry second only to Switzerland's in Central Europe. Their main difficulties revolve around raw material shortages and obsolete plants not renewed during the war years. Sufficient manpower is available despite transfer of 2½ million Germans (20 percent of the population). Because high schools were closed to Czechs during the war, highly skilled personnel, especially trained technicians, is short. Even during the period between the two wars Germany supplied the whole industry with engineers, research and capital—many plants employed only chemists of German origin. Czech producers had to follow the German market. For instance, they shipped daily truckloads of coal tar out of the Ostrava basin to Germany. Then they bought it back as dyes and pharmaceuticals.

Plant Reconstruction

During World War II the Germans gave the industry a boost with several new plants. The most important, the Stalin Works for Synthetic Fuel at Most, was badly bombed towards the end of the war. In 1947, after two years of reconstruction, it produced an estimated third of wartime peak output. Germany built it with large capacity to supply fuel for the Wermacht. Czechoslovakia only wants to fill its own needs, then use the works to produce other synthetic chemicals. Synthetic fuels produced within the country (non-existent before the war) are slated to keep pace with industry and to supply the Two Year Industrial Plan. In 1948, according to the only published figures, the works is shooting for 69 percent increase over 1946 output.

The works uses brown coal as a starting point. Engineers there believe it is most valuable as a raw material. They distill the coal in large Lurgi retorts. Gas and coke are utilized in the usual way and the tar is catalytically hydrogenated to give motor fuel.

In response to cries that it would be cheaper to import fuels, a committee of experts investigated the works. They decreed that it has a fundamental place in Czechoslovak economy but that better organization and technical improvement was necessary. They estimated that proper organization could cut gasoline production costs from $168 to $104 a ton. In addition to a suggested reduction of employees, they count on the rising output of by-products to check expenses. A large plastics factory has begun production

Chemical Industry Production—1947

Chemical	Tons Produced	Percent of Goal
Synthetic fuels	One-third of the wartime peak output	
Nitrogenous fertilizer	132,400	Over 100
Phosphate fertilizer	343,600	90
Ammonia	25,988	109
Sulphuric acid	191,900	Almost 100
Bichromates	961	78
Sodium hydroxide	29,113	93
Soda ash	89,477	96
Potash	2,680	75
Paints and varnishes	23,991	92
Soap	17,384	70
Textile and leather accessory preparations	7,780	50
Solvent	2,470	75
Rayon yarn	4,382	93
Rayon staple fiber	14,494	94
Hollow glass	120,000	Over 100
Plate glass	126,300	Over 100
Small glassware	8,409	Over 100

THEIR PROGRESS. Heavy chemicals are, in general, up to the goals of the "two year plan." Soap, textile and leather chemicals are mostly lagging.

Czech chemical industry is on way to recovery. Most commodities come close to goals set by state.

near Most. Power is being fed into the Bohemian network, and gas into the new long-distance main to Prague, in increasing quantities. Conspicuous absence of a black market gives witness to the adequacy of the ration of gasoline itself.

Last year nitrogenous fertilizer production amounted to 132,400 tons—more than originally planned. New equipment is expected early in 1949 to keep plant capacity apace with growing demand. Rechanneling of urgently needed sulphuric acid to the metallurgical industry held back phosphate fertilizer for some months in 1947. However, higher output towards the end of the year seems to have met agricultural demands. Annual target is 380,000 tons—1947 output was 343,600 tons. Ammonia production for 1947 was 25,988 tons—9 percent more than planned.

Sulphuric acid and bichromate production have had constant difficulties and stoppages due to old-fashioned, worn out plants. New equipment is being installed as fast as the manufacturers can turn it out. Sulphuric acid just about filled its quota in 1947 with 191,900 tons. Only 78 percent of the planned 1,220 tons of bichromates was produced—961 tons.

There wasn't enough salt early last year for sodium hydroxide and soda ash makers to bring their annual output up to the government's marker. Sodium hydroxide was 7 percent off with 29,113 tons—soda ash with 89,477 tons lacked 4 percent. However, production has been rising steadily (it is at an all-time high now) since supplies began to come in from Germany, Austria, USSR and Poland.

Potash, also, far exceeded the governments hopes during the last months of 1947. Earlier raw material set backs kept the annual figure down to 2,680 tons, 75 percent of the planned amount.

Lack of resins, solvents and drying oils is hampering the paint and varnish trade. Shortage of vegetable oils affects the output of soap and margarine. Production for 1947 of paints and varnishes was 23,991 tons, 92 percent of planned figure; production of soap was 17,384 tons, 70 percent of planned figure. About 50 percent of the quota, 7,780 tons, of textile and leather accessory preparations were made and 75 percent, 2,470 tons, of the solvents.

Raw material shortages also held back production of artificial silk (4,382 tons, 7 percent less than planned). Staple fiber output was 6 percent less than planned, 14,494 tons. In Slovakia, where more natural resources are available, production is above the level planned.

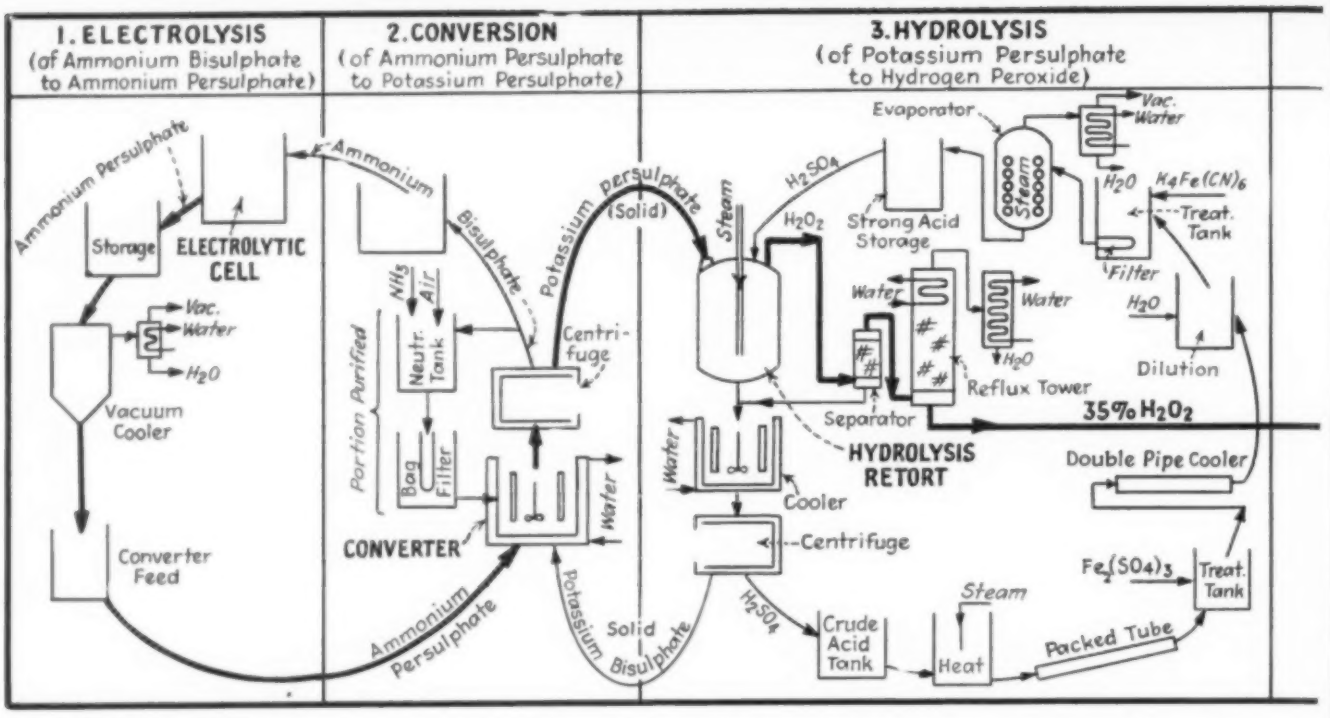
Where there are no raw material bottlenecks and the plan is in good order, production shows some of the best results in the Czech industrial plan. Paper and cellulose output is constantly higher than planned and is now approaching the 1937 level. All types of standard and special paper and many types of semi-finished and fancy paper goods are being produced. Wrapping paper, cardboard and newsprint are being exported to most European countries, South America, India, Palestine, Egypt, USSR, the Far East and Australia. South and southeastern Europe is buying most of the fine cigarette paper. In 1948 twice as much will be exported as in 1947.

Glass, Czechoslovakia's specialty, is also her greatest dollar earner. Second only to the metal-working industry in exports, $54,000,000 worth was shipped out in 1947. Of this, the United States bought $10,000,000 worth, Great Britain, $8,000,000. Switzerland is also a good customer and the USSR is coming up on the list as a buyer not only of plate and sheet glass, but also of cut glass. The industry is now focusing on the manufacture of electric light bulbs, optical and fluorescent glass and the mechanized manufacture of bottles and sheet glass.

1947 Glass Production

Glass makers have enough orders to last the next two years. Production in 1947 amounted to: hollow glass, 120,000 tons; plate glass, 126,300 tons; small glassware, 8,409 tons. Although the transfer of the German population was most noticeable in the glass industry, it actually seems to have affected only the production of small glassware and costume jewelry, and then only to a slight extent. Output of plate glass, for instance, is above 1937 level.

The new nationalization laws will speed up capital investment work in the ceramics industry. They have annexed some 300 more concerns to the various ceramic national corporations. Some of these have excellent mechanical equipment. Deposits of amorphous silica are now insured for the production of Dinas ware for Siemens-Martin steel furnaces, coking ovens and gas works. Much of this amorphous mineral was formerly sold abroad as ordinary silica. Chiefly, brickworks, lime-kilns and cement works have been brought under the large ceramic combines. Principal lines are sold out for at least one year, and no further orders are being accepted for utility and building ceramics of any kind.



TO PRODUCE 35% peroxide they standardized on a well-known method, the Pietsch-Adolf potassium persulphate process shown above. It consumes power and water, recirculates—by cycles shown above, *l. to r.*—$(NH_4)HSO_4$,$KHSO_4$, H_2SO_4.

How the Germans Made H

A visit to a pioneer plant—in an industry where Germany got t

EDITORIAL STAFF REPORT

TWO PROCESSES represent the essence of German's hydrogen peroxide industry. They are the potassium persulphate process for producing 35 percent H_2O_2 and a two-stage distillation process for concentrating this dilute product to 85 percent. The potassium persulphate process is interesting because it is the one, of four commercial prewar processes, which the Germans evidently considered their best and adopted for practically all their wartime expansion.* The distillation process is interesting because it was the sole German peroxide process to be rated "new and important" by U. S. investigators after the war.

So to epitomize the German peroxide industry, which is our purpose here, we want to study a plant employing both these processes. There are two such plants, one at Hollriegelskreuth and one at Bad Lauterberg. Both plants were practically identical as to method and equipment, but the former makes a better example—because it operated longer; because Drs. Pietsch and Adolf, who developed both the processes we're interested in, worked there and were on hand for U.S. interviewers; and because it was thoroughly examined and reported by U.S. intelligence teams. What follows then, is a picture of Hollriegelskreuth, taken almost entirely from the excellent report by Bretschger, Crewson and Cushing. ("German Hydrogen Peroxide Industry," PB17331, April 1946, available only from Dept. Commerce, Washington 25, D.C.)

* Germany's four commercial dilute-peroxide processes and their relative importance are as follows (expressed as 100 percent H_2O_2 but produced as 35 percent):

Process	Prewar Capacity	Wartime Capacity	Under Construction
	(Metric Tons Per Year)		
Potassium persulphate	2,600	15,800	74,000
Persulphuric acid	1,700	2,700	.....
Ammonium persulphate	700	800	.....
Barium peroxide	700	700	.....
	5,700	20,000	74,000

Note that practically all expansion was in the potassium persulphate process; it represented 45 percent of prewar capacity and 79 percent of wartime capacity (and it would have reached 95 percent if plants under construction had been completed).

Germany's capacity to concentrate this dilute product, all by the distillation process developed at Hollriegelskreuth, was as follows (metric tons per yr., expressed as 100 percent H_2O_2 but produced as 80–85 percent): prewar capacity, none; wartime capacity, 17,000; under construction, 66,000.

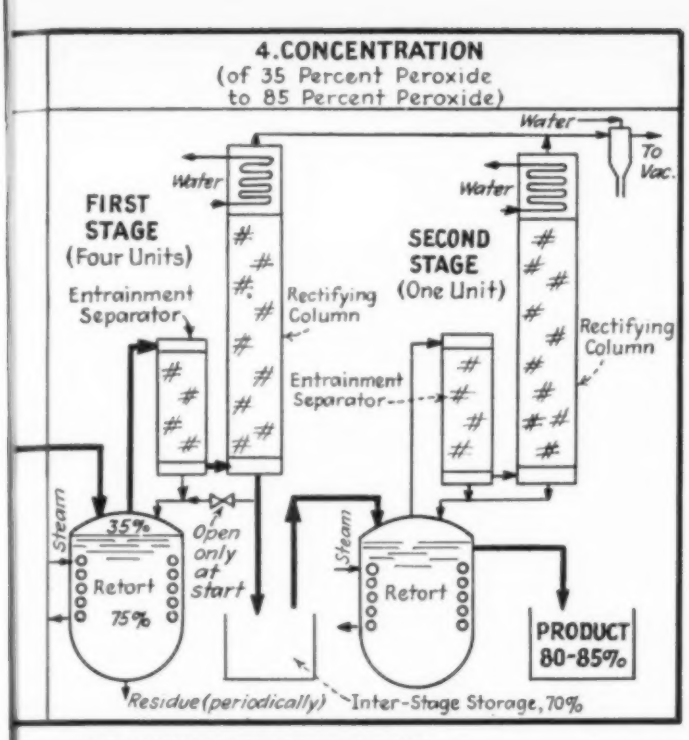
In a Nutshell

The Hollriegelskreuth operation may be divided into four steps: electrolysis, conversion, hydrolysis, and concentration. Each step is performed as follows:

Electrolysis: Electrolyze a solution of ammonium bisulphate in the presence of a small amount of potassium sulphate and an excess of sulphuric acid. Purpose is to get ammonium persulphate. The reaction:

$$2(NH_4)HSO_4 + \text{Energy} = (NH_4)_2S_2O_8 + H_2$$

Conversion: To the ammonium persulphate just formed add potassium bisulphate and cool; since potassium persulphate is least soluble of the salts, it precipitates, leaving in solution the ammonium bisulphate, which is recycled



TO CONCENTRATE TO 85% they developed a "new and important" method, this two-stage distillation process.

To Produce 35% Peroxide	Per Kg. (100% basis) At Full Production
Power, for electrolysis, kwh. d.c.	13.2
For electrolysis (incl. rect. loss), kwh. a.c.	14.7
For other process (incl. vac. pumps, excl. lighting and water pumping), kwh. a.c.	2.9
Total process power, kwh. a.c.	17.6
Steam, for distillation, kg.	13.2
For other process (excl. heating), kg.	11.8
Total process steam, kg.	25.0
Water, as supplied, c.m.	2.4
Supply plus repumped, c.m.	4.8
Platinum, investment, gm. per 1,000 kg. product (100% basis)	330
Loss, gm. per amp. hr.	$1.0/10^6$
Loss, gm. per kg. product (100% basis)	0.00270
Chemical requirements, kg. per kg. H_2O_2 (100% basis)	
H_2SO_4	0.080
SO_2	0.045
$Fe_2(SO_4)_3$	0.080
NH_3	0.080
$(NH_4)CNS$	0.075
$K_4Fe(CN)_6$	0.010
Process labor, total man-hr. per 1,000 kg. product	280
Vacuum, displacement at 40 mm., c.m./hr. per 1,000 kg./mo.	60
To Concentrate from 35% to 82% Peroxide	
Power, kwh. a.c.	0.10
Steam, kg.	5.8
Water at 11 deg. C., c.m.	0.4
Process labor, man-hr.	20
Vacuum, displacement at 40 mm., c.m./hr. per 1,000 kg./mo.	8

TOTAL COSTS, for above requirements plus overhead, came to 41c. per lb. (on 100% basis; at Reichsmark = 40c.).

e High-Test H_2O_2

got the jump on the rest of the world.

to the electrolysis step. Purpose is to get solid potassium persulphate. The reaction:

$$(NH_4)_2S_2O_8 + 2KHSO_4 = K_2S_2O_8 + 2(NH_4)HSO_4$$

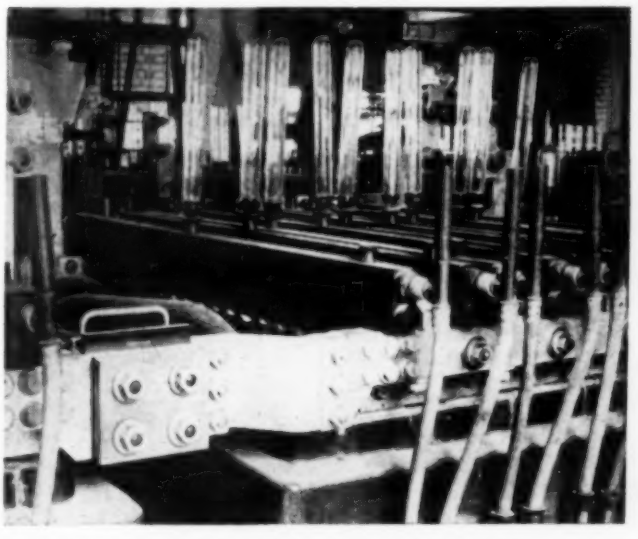
Hydrolysis: To this crystallized potassium persulphate, add strong sulphuric acid to form a slurry; heat with live steam. The potassium persulphate is hydrolyzed to form hydrogen peroxide and potassium bisulphate. The peroxide is vaporized by the steam, then rectified; the bisulphate is recycled to the conversion step. Purpose is to get hydrogen peroxide solution of 35 percent concentration. The reaction:

$$K_2S_2O_8 + 2H_2O = 2KHSO_4 + H_2O_2$$

Note that by recycling, the net result of the three reactions becomes: water + energy = hydrogen peroxide + hydrogen. The other chemicals—ammonium bisulphate, potassium bisulphate, sulphuric acid—are merely recycled. But they have to be cleaned up and adjusted before they can be used over, and these purification steps add considerable equipment to the process flowsheet (notably the sulphuric acid cycle).

Concentration: Distill the 30–35 percent peroxide under vacuum in special equipment. The trick is to distill in two stages; then the impurities stay behind in the first-stage retort and the pure, hence stable, peroxide can be taken to high concentration in the second stage. Purpose is to get 80–85 percent peroxide of maximum purity.

In the first three steps, which constitute the well known Pietsch-Adolf process, the Germans had developed nothing superior to good American practice. But in the fourth step, concentration, the Germans led the world, and the findings of U. S. investigators were of interest and material benefit to our own producers. That was in 1945 and 46; by now U.S. producers have pushed beyond what they learned from the Germans and are producing 90 percent peroxide as a regular thing; which is 5 percent higher than the commercial German product.



Electrolytic Cells—*Wherein Persulphate Is Born*

Step 1: Electrolysis

Each electrolytic cell (above) is a stoneware tube 950 mm. long, 700 mm. wide and 900 mm. deep. Seven carbon blocks, or slabs, rest side by side on top of the cell and entirely cover it. (They are not visible in the photograph; those are cooling water manifolds). Each of the inner five

blocks is pincushioned with 14 anodes, 30 cathodes, and 32 coolers. These are arranged in five rows running the length of the block. Down the middle is a row of 14 anodes. On either side of that is a row of 15 cathodes. And outside each of these is a row of 16 coolers; tops of one row of coolers can be seen hanging from the nearest manifold. The anodes are platinum wire strung on a supporting frame. Cathodes are graphite rods. Coolers are the bayonet type made of glass. Within one cell all anodes are in parallel and all cathodes are in parallel; all coolers in the entire installation are in parallel. To form a permeable membrain between anode and cathode, each cathode rod is wrapped with 3 mm. of blue African asbestos; it was said that no other type of asbestos would do. The distance from an anode to the four nearest cathodes is about 5 mm. Cells are ventilated to get rid of hydrogen; air connections are through the two end blocks, which carry no electrode assembly.

Per cell, then, there are 5 of these cover block assemblies, with a total of 70 anodes, 150 cathodes, 160 coolers, 3,600 sq.cm. of anode surface and 6 sq.m. of cooler surface. In all, the cell room contains 112 cells divided into four groups of 28 cells each. Each group is one electrical series but is divided into four solution series of 7 cells each. (In normal operation only 26 of the 28 cells in a group are working, which means that two of the four solution series operate with six instead of seven cells.)

Electrolyte distribution: Net volume of each cell is about 340 liters. Normal flow through the entire system at full load is 24,000 liters per hr., which is divided down to 6,000 liters per hr. per electrical series, or 1,500 liters per hr. per solution series. Typical analysis of the electrolyte entering and leaving the cell room:

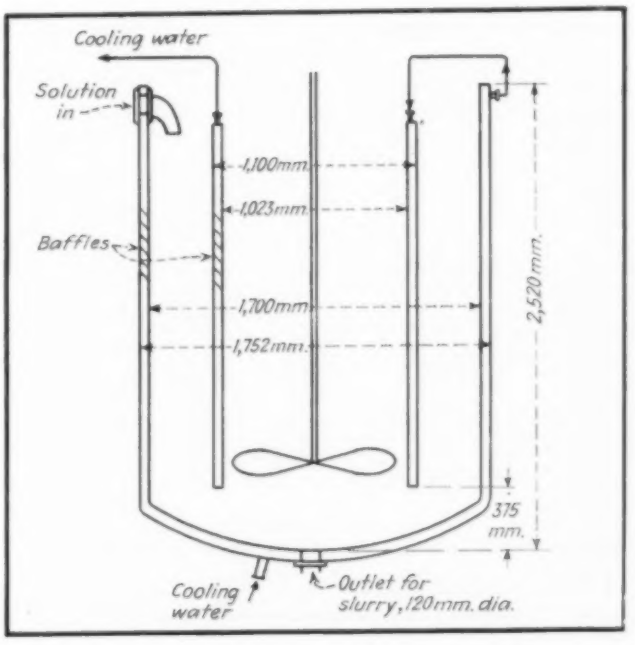
	Electrolyte At Inlet	Electrolyte At Outlet
Density, deg. Be	25.5–26.5	25.5–26.5
H_2SO_4 free, g.p.l.	60–80	40–45
H_2SO_4 total incl. persulphates, g.p.l.	95–110	95–110
O_2 persulphate equivalents, g.p.l.	5–6	10–12
KNO_3 max., g.p.l.	2.5	2.5
Fe, mg.p.l.	70–100	70–100
K_2SO_4 total incl. persulphates, g.p.l.	35–40	35–40
$(NH_4)_2SO_4$ total incl. persulphates, g.p.l.	290–300	290–300

By controlling the flow rate of cooling water the solution in the cells is held between 38 and 40 deg. C. Higher temperature causes loss of efficiency; lower causes crystallization in the cell. Water enters the coolers at 18 deg. C. and leaves at 22; it cannot be too cold or salt crystallizes on the surface of the coolers. To prevent sedimentation inside the coolers, pure water is used in a closed cooling system with a heat exchanger.

Current distribution: The entire cell room draws 18,000 amp., 4,500 through each of the four electrical series. Voltage drop per cell is held between 5.6 and 6, or around 150 v. for an entire electrical series of 26 cells. Current efficiency is normally 82–83 percent; anode current density, 1.25 amp. per sq.cm.; cathode c.d., 0.5 amp. per sq. cm.

Much study has gone into the problem of platinum loss from the anodes. The general conclusions are that to minimize the loss: (1) Anodes should be designed for current density of 2–4 amp. per sq.cm. (2) Platinum should be alloyed with 0.1 percent iridium. (3) Caro's acid (H_2SO_5, formed in a side reaction in the electrolyte cycle and present in the electrolyte in 0.005–0.01 N strength) should be completely removed from the electrolyte by SO_2.

Electrolyte from the cells is collected in storage tanks, then pumped through a vacuum cooler. This cooler is essentially a stoneware and glass vessel with barometric discharge leg. The solution is cooled 10 deg. C., from 38 to 28 deg. C., by flash evaporation of about 400 liters of water per hour. Absolute pressure in the head tank runs around 28 mm. Any greater cooling causes potassium salts to crystallize and foul the cooler. From the leg of the cooler the solution is pumped to the converters.



Converter—*Wherein Persulphate Swaps Horses*

Step 2: Conversion

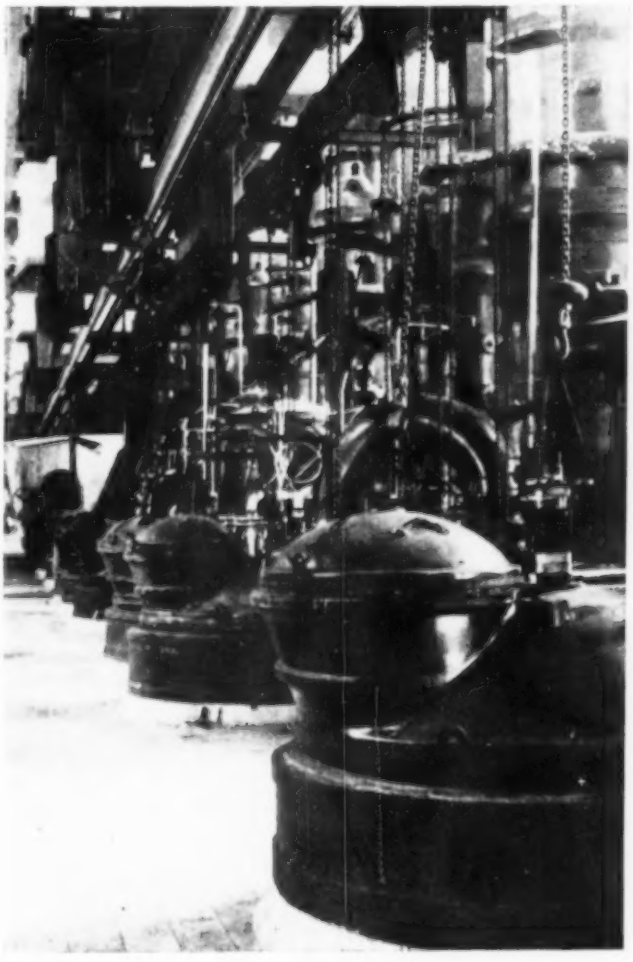
There were seven converters, each consisting of two identical tanks in series. The drawing shows their construction; they are agitated by an upthrust impeller in a center well, and both the center well and the tank body are water jacketed. Well water enters at 11 and leaves at about 14 deg. C., following the course shown. The contents are cooled to 14–16 deg. C. They made the converters of a stainless steel identified as V4A (0.07C max., 18Cr, 8Ni, 2.2Mo). Solid potassium bisulphate is added to the solution in the converters to precipitate potassium persulphate. The amount added is the theoretical quantity to reduce the active oxygen content from 2.4N to 0.6N. To attempt further removal causes buildup of potassium salts in the electrolyte and consequent crystallization in the electrolysis cells. Thus it is that persulphate salts show up in the electrolyte recycled to the cells (see table at left under "electrolyte at inlet").

From the converters the $K_2S_2O_8$ slurry is pumped to six centrifuges. These are horizontal, 680–700 rpm., self discharging, with baskets 1,500 mm. in diameter and 600 mm. deep. They hold 300 kg. per batch and are made of V2A stainless steel (18Cr, 8Ni); it is felt that V4A, containing 2.2 percent Mo, would be preferable. Over-all cycle time is 40–45 min. per batch; this includes loading, spinning, washing with 30 liters of distilled water, spinning to final dryness of 6–8 percent water and unloading.

Mother liquor from the centrifuges is drained to stoneware storage tanks where it is standardized for reuse as cell feed. Water losses, mostly in the flash cooler, are made up, and 0.1 gm. per liter of NH_4CNS is added to increase anode potential and current efficiency (by 4–5 percent) in the cells. Each day some 3,000 liters of electrolyte is withdrawn from the centrifuge effluent for purification; in stoneware vessels the solution is neutralized and made slightly alkaline with gaseous ammonia, which precipitates iron

and other metallic impurities, then passes through bag filters made of a synthetic fiber like Vinyon. Purified solution is returned to the converter.

Solid potassium persulphate salt from the centrifuges is carried by belt conveyor and overhead trolleys to the hydrolysis equipment.



Hydrolysis Retorts—*Wherein Persulphate Becomes Peroxide*

Step 3: Hydrolysis

A trolley scale in the overhead system (*upper left, above*) weighs batches of the persulphate for the hydrolysis retorts. There are twelve retorts, of which 10-11 are enough for normal full production. As can be seen, they are made of chemical stoneware.

The foreground retort is ready to begin operation. Chains are in place to lift the cover and a 1,000 kg. batch of $K_2S_2O_8$ is being brought up in the bucket. After this is charged, 280 liters of 50 deg. Be. H_2SO_4 will be pumped in, the retort closed, evacuated, and live steam admitted. The steam inlet is a porcelain pipe about 50 mm. in diameter which passes down through a gland in the top of the retort so it can be raised and lowered; a chain is now attached to raise it. The lower end is perforated with 5-mm. holes and at the start these perforations will be placed just below the surface of the slurry. Gradually it will be lowered until at the end of 15 or 20 min. it will be resting on the bottom. Steam comes from the mains at 12–14 atm. and is reduced to 4 atm. at the retort inlet; this plus the further reduction to the still's absolute pressure results in considerable superheat in the expanded steam. At first the steam flowrate is retarded but when the pipe is down it is constant at 300–320 kg. per hr. Time cycle is 4–4½ hr. per batch. Temperature in the retort is 75–80 deg. C.

Vapors pass from the top of the retort through an entrainment separator (a packed column) and into a rectifying tower. There is one separator and one tower for each retort. The tower is 1,050 mm. in diameter, packed with 25 mm. Raschig rings to a height of 4,000 mm. Aluminum reflux condensers are built into the top. Three of these towers have been rebuilt, replacing the condensers with water sprays because the sprays permit better control. In the spray-equipped units the reflux rate is 80 liters per hr. for the first two hours and 50–60 for the remainder of the cycle. Reflux rates on the condenser-equipped units are presumably about the same.

Normal production is equivalent to 4,000 kg. of persulphate, or 500 kg. H_2O_2 (theoretical, 100 percent), per day per still; this can be pushed up to 600 kg. H_2O_2 (100 percent yield, 100 percent H_2O_2) per day per still, thus accounting for the use of only 10-11 units for a capacity of 150,000 kg. per month.

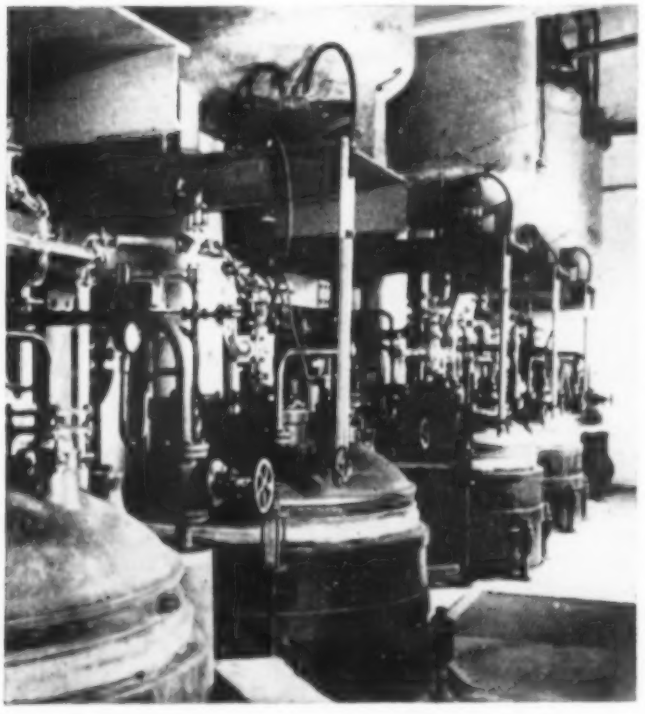
At the start of a batch H_2O_2 runs as high as 10 percent in the retort vapors, 50 percent in column rundown. After about two hours hydrolysis slows down and peroxide concentration falls off steadily till by the end of the 4–4½ hr. distillation period it reaches less than 1 percent in the vapors and about 20 percent in the rundown. The end-point is governed by yield versus steam-cost for recovery. Average concentration of the rundown, which is the product, is 35 percent. This is standardized in storage tanks and sent to the high concentration plant.

Vapors from the rectifying towers are caught by surface condensers, one per tower, consisting of aluminum coils in stoneware columns. Around 1 percent of the peroxide produced is lost in this vapor. As will be seen, another 2 percent is lost in the acid remaining in the retort. The average over-all yield for conversion plus hydrolysis is 87 percent (range, 85–90), this being the ratio of hydrogen peroxide product to the equivalency of the persulphate from the electrolysis cells.

The slurry in the bottom of the retorts after each batch distillation must be processed for recovery of $KHSO_4$ and H_2SO_4. In coolers, similar to the converters, but a little smaller, the slurry is cooled to about 18 deg. C. In two centrifuges, of 1,000kg. capacity each, the $KHSO_4$ is separated from the acid and washed. The salt is carried in carriages to the converters for reuse; it is too sticky and too corrosive of rubber to be handled by belt conveyor like the persulphate salt.

Drainage from the centrifuges is H_2SO_4 of about 40 percent and containing active oxygen equivalent to some 2 percent of the initial active oxygen from the electrolysis cells. This oxygen is about 60 percent peroxide and 40 percent Caro's acid. In addition it contains metallic impurities, mainly iron and platinum. Although preceeding operations are batchwise, acid purification is continuous at about 800 liters per hr. First it is heated to 105 deg. C. to remove active oxygen. Then, it goes through porcelain tubes packed with small tantalum Raschig rings and from there to three stoneware treating tanks where ferric sulphate is added. These tanks are in series and, having a volume of 800 liters each, provide a combined retention time of about 3 hr. A tantalum double-pipe cooler brings the acid temperature down to 60–80 deg. C. Next the acid is diluted to 10N and pumped to a 15,000 liter rubber-lined steel tank with inner facing of tile. Here they test for iron, add enough $K_4Fe(CN)_6$ to precipitate iron as Prussian blue, agitate with air for half an hour and let the tank

settle for half an hour. The precipitate is collected from time to time and sent away for platinum recovery. The clear supernatent liquor is pumped through porous ceramic thimble filters to a concentrator. This is a stoneware pot with a gold steam coil. They concentrate the acid to 50 deg. Be. and return it to storage for supply to the retorts. The condenser on the concentrator works at 10 mm. pressure and consists of aluminum coils in a stoneware tower.



Concentration Retorts—*Wherein Peroxide Becomes More So*

Step 4: Concentration

As far back as 1936 the German government recognized the value of strong peroxide solutions for military purposes. After five or six years work, the Electrochemische Werke München developed a commercial process; it was installed first at EWM's Hollriegelskreuth plant (*above*) and later in four much bigger wartime plants, of which only the one at Bad Lauterberg was ever completed.

The original product, dubbed Tn, was 80 percent H_2O_2 and was obtained by direct, one-stage distillation. It was high in impurities and even with a lot of stabilizers added was of unreliable stability; residues made it unsuitable for jets and other such energy machines. With the development of two-stage distillation, in which the first stage is really a purification step, came grades Ts and Tss, of 82 and 85 percent respectively. Tn was forthwith abandoned and the process as described here is for Ts and Tss.

Equipment: Feed to these concentration retorts is the ordinary 35 percent solution produced in the base process. The retorts are stoneware vessels 1,200 mm. in diameter and 1,650 mm. deep; each has a gross capacity of about 1,400 litres. Within the retort is a coil made of V14A stainless steel (17.5 Cr, 12.5 Ni, 4.7 Mo, 0.07 C max.). The German engineers have said that the process owes its success to this particular stainless steel; no other grade has been found satisfactory. The coils were polished when installed but do not require repolishing when continued in service. They are helical in form and consist of five turns on 830 mm. mean diameter. The tubing is 35 mm. O.D., having 2.5 mm. wall thickness. Mean heat transfer rate is said to be 5,000 kg. cal./sq.m./hr./deg. C. Steam in the coil is at 3–5 atm. pressure.

Vapors from the retorts pass through separators for entrainment removal (*upper right*). They are short aluminum columns 1,000 mm. in diameter and packed to a depth of 500 mm. with 25-mm. porcelain rasching rings.

Next the vapors go to chemical stoneware fractionating columns. They are 1,050 mm. in diameter and contain 25 mm. porcelain rashig rings to a depth of 4,000 mm. Aluminum reflux condensers are built into the top of the towers, from which the exit vapors pass to jet condensers. The distilled, semi-concentrated product from this first, or purification, stage is withdrawn from the bottom of the rectifying tower.

One such retort, separator, and rectifying column constitute a unit; four such units are installed for the primary distillation.

For the second, or concentration stage, identical equipment is used, except that the rundown from the rectifying column is returned to the retort and the final product withdrawn from the retort. Only one unit is required for this stage.

Operation: In normal operation, 1,000 liters of the 35 percent peroxide is introduced into the first-stage retort as an initial charge. The equipment is evacuated and steam turned into the coil. As evaporation proceeds, the underflow from the column is returned to the retort until the concentration in the retort reaches approximately 75 percent. Additional feed solution is added to maintain level in the retort. When the retort solution gets to 75 percent it produces vapor of approximately 35 percent, corresponding to the concentration of the feed liquor. It takes about three hours to reach this equilibrium. Thereafter, rundown from the rectifying tower, instead of being returned to the retort, passes to several small aluminum tanks for inter-stage storage. Maintaining the 75 percent concentration in the still and 35 percent in the feed and vapors, feed and evaporation are continued, with an accumulation of impurities from the feed solution remaining in the retort. Tower underflow for this condition is approximately 70 percent H_2O_2 of high purity. The rate of feed after equilibrium is reached is about 600 liters per hr. per still. This can be maintained for about five days, when the accumulated impurities make it necessary to remove the residue from the retort and start a new cycle. The total feed for a cycle is thus approximately 72,000 liters of 35 percent solution, and the amount removed as residue at

	Original Grade (Tn)	Improved Grade (Ts)	Best Grade (Tss)
Hydrogen peroxide, wt. %	80	82	85
Residue on evap. ppm.	5,500	(580)	800
Residue on ignition, ppm.	3,000	(20)	300
Acidity, mil. equiv. per liter	8-10	1.0	1.5-2.0
Free H_3PO_4, ppm.	—	20	(150)
Free H_2SO_4, ppm.	500	5	5
Combined H_2SO_4, ppm.	700	—	—
8-Hydroxyquinoline, ppm.	500	—	(300)
Sodium pyrophosphate, ppm.	300	—	(200)
Chlorine ion, ppm.	—	—	—
NH_4 ion, ppm.	200	—	—
Aluminum	Trace	Trace	Trace
DN, max.	5	5	5

DN is the percentage of the total H_2O_2 which is decomposed on heating for 24 hr. at 96°C. The factor used to anticipate the storage life for one year at ambient temperatures is DN 5 = 1 percent decomposition per year.

THEIR PRODUCT evolved through three stages. First came 80 percent H_2O_2, purification pushed it up to 82 percent, inhibitors to 85. (Circled values tell the story.)

the end is 1,000 liters of 75 percent solution; the residue contains about 3.5 percent of the H_2O_2 fed to the still. The impurities increase 72 fold in the liquor in the still, making it unstable and unsafe to continue.

The 70 percent solution from the first stage becomes the feed for the second. The second stage process is identical with the first, except that the product is withdrawn from the retort and the rundown from the fractionating tower is all returned to the retort. A single second-stage unit can handle a feed of about 1,200 liters per hr., corresponding to the capacity of four first-stage units. Operation of this concentration stage is said to be continuous, with no fouling of the coil or accumulation of residues, as compared with the cyclic operation of the first-stage distillation. After leaving the retort of the concentration stage, the product is cooled in a double pipe, stainless steel (V14A) cooler, and then held in aluminum tanks for shipment. All concentrated peroxide is shipped in aluminum tank cars. It is handled by stainless steel pumps, aluminum piping and stoneware valves.

Yield: To obtain maximum yield, the residue periodically removed from the retort of the first stage is diluted with water and redistilled in a separate unit for recovery of its peroxide content as a weak solution. Without recovery of peroxide from the residue, the yield, based upon H_2O_2 content in product with respect to that in feed, is about 95 percent. With recovery of the residue peroxide, this yield becomes about 98 percent. (These are the values claimed by the Germans, but no supporting data for them has been found; they probably represent best anticipated results, rather than consistant practice).

Control: Successful operation of this process depends upon close control of the retort temperature, hence its pressure. The pressure in the retort of the first stage is 50–60 mm. absolute, which permits a boiling temperature of about 62deg. C. This temperature is never permitted to exceed 63 deg. C., and a thermostatic steam control valve is used to hold it there. Similarly, the temperature in the retort of the second stage is not permitted to exceed 72 deg. C., and its steam supply is also under thermostatic control. A pressure of 50–60 mm. absolute in the retort is also required to control its temperature.

To obtain such pressures in the retorts requires maintenance of 28–32 mm. absolute pressure at the top of the tower. Thus, the cold well water at 16 deg. C. is needed for condensing purposes.

It has been determined that concentrations above 85 percent are unsafe to attempt by this process. At concentrations approaching 90 percent, or if the temperature exceeds 72 deg. C, flashes of blue light can be seen through the sight glasses of the retort, showing the beginning of rapid decomposition. Because of the critical approach to a hazardous condition in the still, it is considered that maintenance of constant and low absolute pressure is essential. To accomplish this, a steam jet booster is installed between the condenser and the mechanical vacuum pump, making it possible to maintain the required 28–30 mm. absolute pressure at the top of the the rectifying towers.

Stabilizers: When the 35 percent product is to be distributed as such it is stabilized with 300 ppm. of sodium pyrophosphate and 100 ppm. of 8-hydroxyquinoline. When it is to be concentrated it is stabilized with 200 ppm. of sodium pyrophosphate and 100 ppm. of 8-hydroxyquinoline. In addition, when making the Tss grade (but not with Ts), 5 ppm. of phosphoric acid is added to the intermediate 70 percent solution. The 70 percent concentrate from the first distillation stage contains approximately 10 ppm. of residue upon evaporation, of which 5 ppm. is represented by its acidity. These impurities are occasioned by the entrainment not removed from the vapors by the separator.

Ceramic Raw Materials

PRODUCERS and suppliers of the mineral raw materials that go into the ceramic industry have uncovered new mineral deposits, mechanized their mining operations and applied new methods of ore dressing and beneficiation. As a result, manufacturers get abundant raw materials of better quality and greater uniformity.

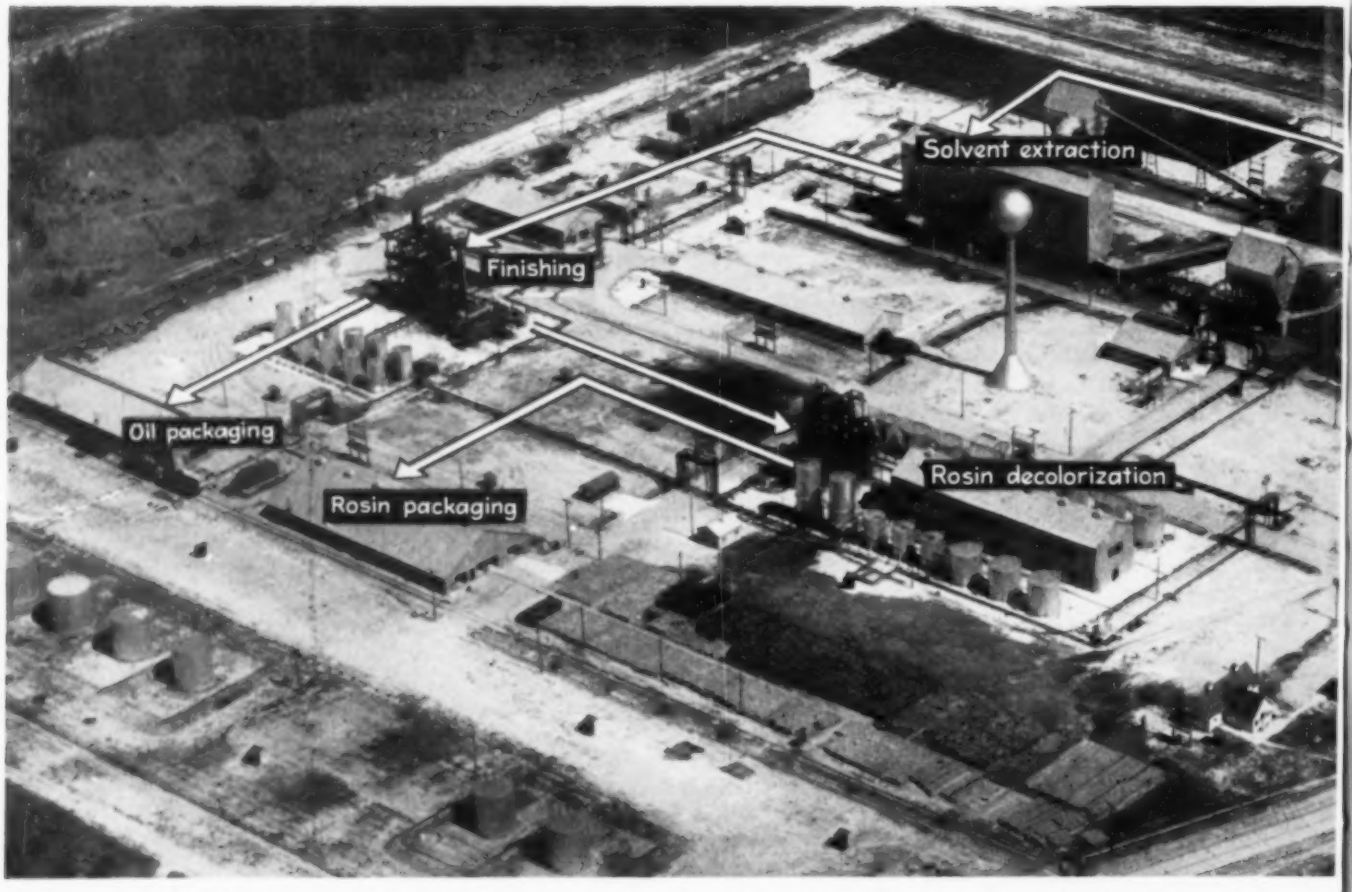
Of current interest are the talc mining operations of the R. T. Vanderbilt Co. in upstate New York. Work done by the U. S. Bureau of Mines has led to the recovery of beryl from low-grade ore deposits in New England. A big new deposit of pyrophyllite has been discovered in the middle of Pennsylvania, close to the clay industry of Pennsylvania, Ohio and West Virginia.

High-grade potash feldspar is becoming scarce. By flotation, however, the feldspar coming from existing deposits is being upgraded. Another development has been the use of ion exchange in the treatment of clays.

Today, ball and china clays of controlled quality are obtainable. Both composition and particle size of flint and feldspar are controlled. Among the most promising body constituents are talc, pyrophyllite, zircon, kyanite, beryl, nepheline svenite, fluorspar, apatite, spodumene and lepidolite. Much California talc goes into electrical porcelain. Pyrophyllite, a source of silica, is used in the tile industry and by the frit makers. Twelve years ago, almost no nepheline svenite went into ceramics; today, more than one-fourth of all flux used is nepheline svenite. In nepheline syenite research, Dr. Charles J. Koenig of Ohio State has led the way. Introduced recently, lepidolite, a low-melting source of alumina, is used in the glass industry as a flux. It is also used in certain porcelain enamels and in porcelain and pottery bodies. Lepidolite and nephiline svenite are used together as a multiple flux in new low-temperature vitreous bodies. Basic lithium chemicals, notably the carbonate and fluoride, are increasing in use. Foote Mineral Co. supplies them.

There are, in addition, various manufactured raw constituents. These include the alkaline and alkaline-earth zirconium silicates, alkaline-earth titanates, calcined titania or rutile, garspar (mixture of ground glass and silica), alkaline-earth carbonates, fused silica, synthetic mullite, silicon carbide and the refractory oxides (alumina, magnesia, beryllia, zirconia and thoria). An important supplier of some of these materials is Titanium Alloy Mfg. Co. Important auxiliary agents are the electrolytes, wetting agents, binders, plasticizers, lubricants and anti-sticking agents. Socony-Vacuum has done much work recently on wax emulsions as plasticizers. All of these auxiliary materials make possible the forming and handling of ware, but they are usually burned out in firing.

Raw materials play a big part in development of new compositions and in control of product quality. Great progress has been made by producers of raw materials and manufacturers of ceramics in testing materials to insure uniformity and to permit closer control of products. The industry is approaching a condition of control-consciousness, although in many cases its importance is not yet fully realized.



BETTER CONTINUITY. Note straight-line arrangement of stumpwood grinding and preparation buildings. Continuous processing also replaces batch in decolorization and in finishing unit, where extract liquor is fractionated.

Naval Stores *New Plant Does Old*

Modern methods—from continuous processing to outdoor construction—bring an old

J. V. Hightower
Southwestern Editor
Chemical Engineering

NEWPORT INDUSTRIES has incorporated in its solvent extraction-steam distillation plant at Oakdale, La., several improvements in design and operation resulting from the company's experience at its wood naval stores plants at Bay Minette, Ala., Pensacola, Fla., and De Quincy, La. The Oakdale installation, formally opened last November, was designed and constructed by Stone & Webster Engineering Corp. in collaboration with Newport engineers. The plant features (1) continuous rather than batch operation at several points, (2) use of a combination aromatic-naphtha solvent giving higher rosin yields and (3) more efficient methods of handling the stumpwood in the plant.

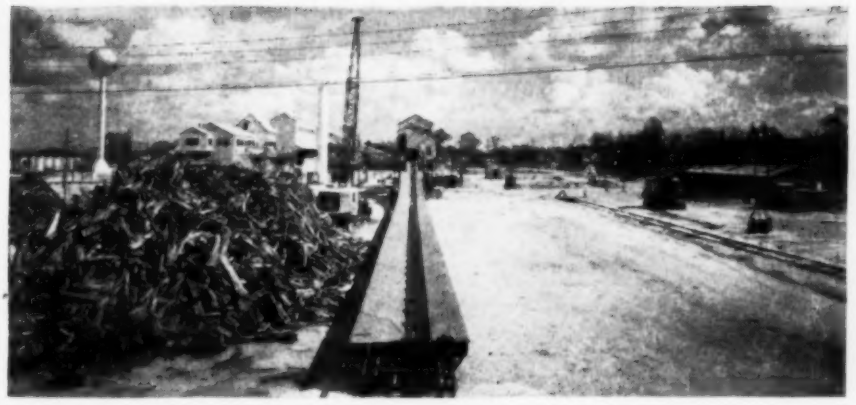
An additional feature, characteristic of petroleum refining practice, is the installation of as much unhoused equipment as possible. This eliminates expensive buildings and reduces the possibility of accumulating flammable vapors.

Newest Plant

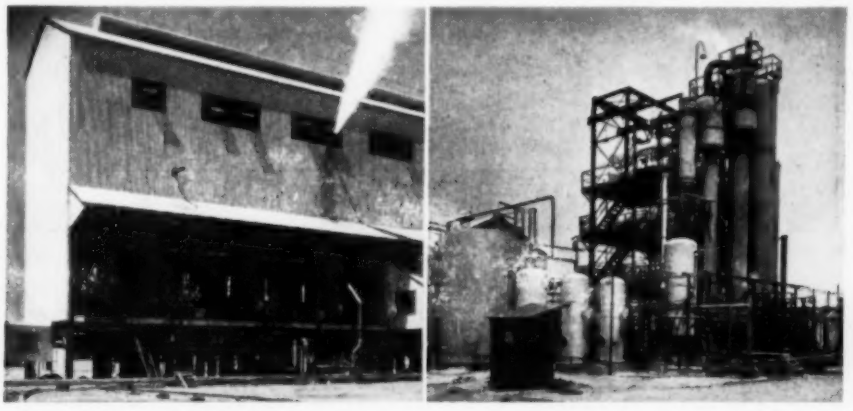
The plant at Oakdale is the most recent to be put into operation along the Gulf Coast. It processes 500 tons of pine stumps per 24-hr. day and derives from this, on the average, 100 tons of rosin of all grades and a total of 6,000 gal. of oils. The oil yield at present is being manufactured into turpentine, pine oil and dipentene. The company plans later to enter into the production of a broader list of products than those now produced.

The company has found that the use of heavy "stumpdozers," caterpillar type tractors equipped with pronged castings, gives a more efficient recovery of stumps from the field than is possible by the use of dynamiting, which often leaves parts of the roots in the earth. At the plant, a decided reduction in labor, as well as a saving in space, is accomplished by the use of diesel-powered cranes in handling the stumps. In the field, the stumps are loaded upon modified cargo slings laid across the trucks. When the trucks are driven into the plant a crane lifts the entire sling-load, quickly hoists it to the stock pile, releases the sling and then replaces it upon the truck. The unloading operation requires only about five min. as compared to 20 to 30 min. by manual labor. The use of a crane has the further advantage that the stumps can be piled higher than is practicable when





BETTER HANDLING. Machines replace men in stumpwood handling. "Stumpdozers" root it up; trucks, cranes and conveyor shoulder it into plant.



BETTER RECOVERY. By using a new solvent combination, retorts in extraction building (left) deliver more rosin to decolorizing towers (right).

Job Better

industry up to the minute

the job is done by hand. This means a saving in storage space.

Specially modified orange-peel grabs, also on diesel cranes, transfer stumps from the pile to the 350-ft. steel chain conveyor taking the wood to the "hog" house where the material is reduced to small bits. This, too, represents a considerable saving in labor.

Newport Industries found out from experimental work at Pensacola that an appreciable increase in the recovery of rosin could be realized by using a solvent of high aromaticity in the wood extraction phase.

Continuous Processing

An instance of continuous, as opposed to batch, processing is the finishing of dark rosin. In this operation the rosin liquor (solvent plus rosin and other products from the wood extraction phase) from the extractor house is pumped to a group of holding tanks. From these the liquor is discharged continuously into a stripper where solvent is taken off overhead. Bottoms from the solvent stripper move to the rosin stripper, a bubble cap tower where the oils are removed overhead, and the dark rosin is discharged at the bottom and sent to the Pale plant for color reduction.

After the dark rosin is mixed with naphtha solvent and color bodies are settled out, the material is pumped through filter towers filled with fullers earth and thence to holding tanks. From these the solution moves continuously to an evaporator where solvent is removed and the finished pale rosin is pumped from the bottom into steam heated, insulated tanks before being drummed.

At the same time, B-resin, the dark material resulting from the decolorizing of the rosin, is continuously freed of residual solvent in an evaporator and pumped to storage.

Newport Industries has stressed at its Oakdale plant the installation of processing equipment in the open. Here is followed the practice of the petroleum refining industry in a climate where snows and extremely cold weather are rare. It was decided there was no point in housing rugged equipment in costly buildings when it could be erected in the open without serious problems of operation, corrosion and hardships to operators.

Unhoused Finishing Unit

Thus, the rosin finishing unit, where dark rosin is separated from the crude oils and the solvent after the extraction phase, stands in the open along with its tankage. Likewise are designed the strippers used for the production of pale rosins and B-resin at the Pale plant. In the construction of all processing equipment the policy was to reduce to the minimum the housing of equipment where flow is continuous and requires little attention from operators.

Plant officials are: H. L. Smith, manager of Louisiana Operations; H. E. Rose, superintendent; W. L. Shepherd, assistant superintendent in charge of maintenance; P. T. Cornelius, assistant superintendent in charge of operations; S. W. Baldwin, personnel manager; and F. A. Ray, woods superintendent.



THE TREND IS WEST

Here, graphically, are the growth patterns of the various areas in the last 48 years. The westward movement clearly shows up. This slow but sure change in industrial location will have its future effects on the chemical industry, too.

Industrial Migration

DURING the war, strategy dictated the locating of hundreds of plants in new centers. Atlanta, Dallas, Kansas City, Des Moines—and farm belt towns with only tiny industrial operations—suddenly saw industrial giants sprout. Hampton Roads, Charleston, Mobile—and other sleepy southern ports—suddenly began to roar with the fevered pace of wartime shipbuilding. The Far West swelled with new aircraft plants and ship yards. Houston, Los Angeles, and Salt Lake City suddenly saw the smoke of new steel mills. El Dorado, Morgantown, and Henderson poured forth industrial chemicals.

But postwar construction shatters the wartime record in the South and West. In the first and exclusive report on the new migration, *Chemical Engineering* reveals a spectacular development in United States industry.

One half of all of today's new plants are going up in the South and West—which had only little more than one-fourth of all the prewar plants. The New England, Middle Atlantic, and the Great Lakes states, which had 72 percent of all U. S. manufacturing jobs before the war, got only 55 percent of the new wartime plants built with private or government funds. And they are getting only 45 percent of the new plants now.

Location Reasons

There are many reasons for deciding where to locate a plant, and they are weighted differently in each case. They range from natural resources through cost differentials and markets to government policies and industry practices.

Among the top in new factors, though, is government action. Development of TVA and Bonneville power, for example, laid the groundwork for new aluminum and chemical plants. Putting defense plants into new centers not only changed the industrial map in wartime, but gave impetus for new growth. Postwar reductions in differentials between rail freights in the East and those in the South and West added new incentives. The Supreme Court's decision on the basing point system of setting prices has accelerated a 10-year-old trend away from it in industry. With other factors, it increases the seaboard's chances of getting new steel plants.

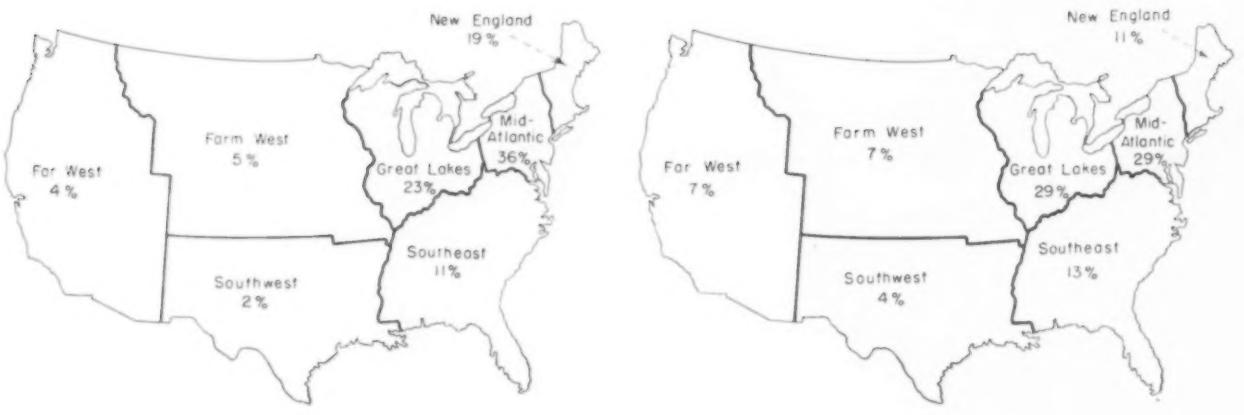
More important than government action is the great change in consumer markets. The regions in the South and West have increased their shares of U. S. incomes from 38 to 44 percent since 1939. That increase is much larger than the regions' wartime gain—from 28 to 31 percent—in their share of the nation's industry. So the West and South came out of the war with less industrial capacity, relative to their consuming markets, than they had when war began. The Far West states saw their populations grow spectacularly, of course. But, even more important, was a healthy gain in per capita income in the other regions of the South and West. In order, by the size of increases in income, the regions rank this way: Far West, Southeast, Southwest, Farm West, Great Lakes, Middle Atlantic, and New England.

Differentials in costs between the regions have changed, but much less abruptly. The Interstate Commerce Commission has boosted freight rates since before the war by 12 percent more for eastern than for southern or western manufacturers in many lines.

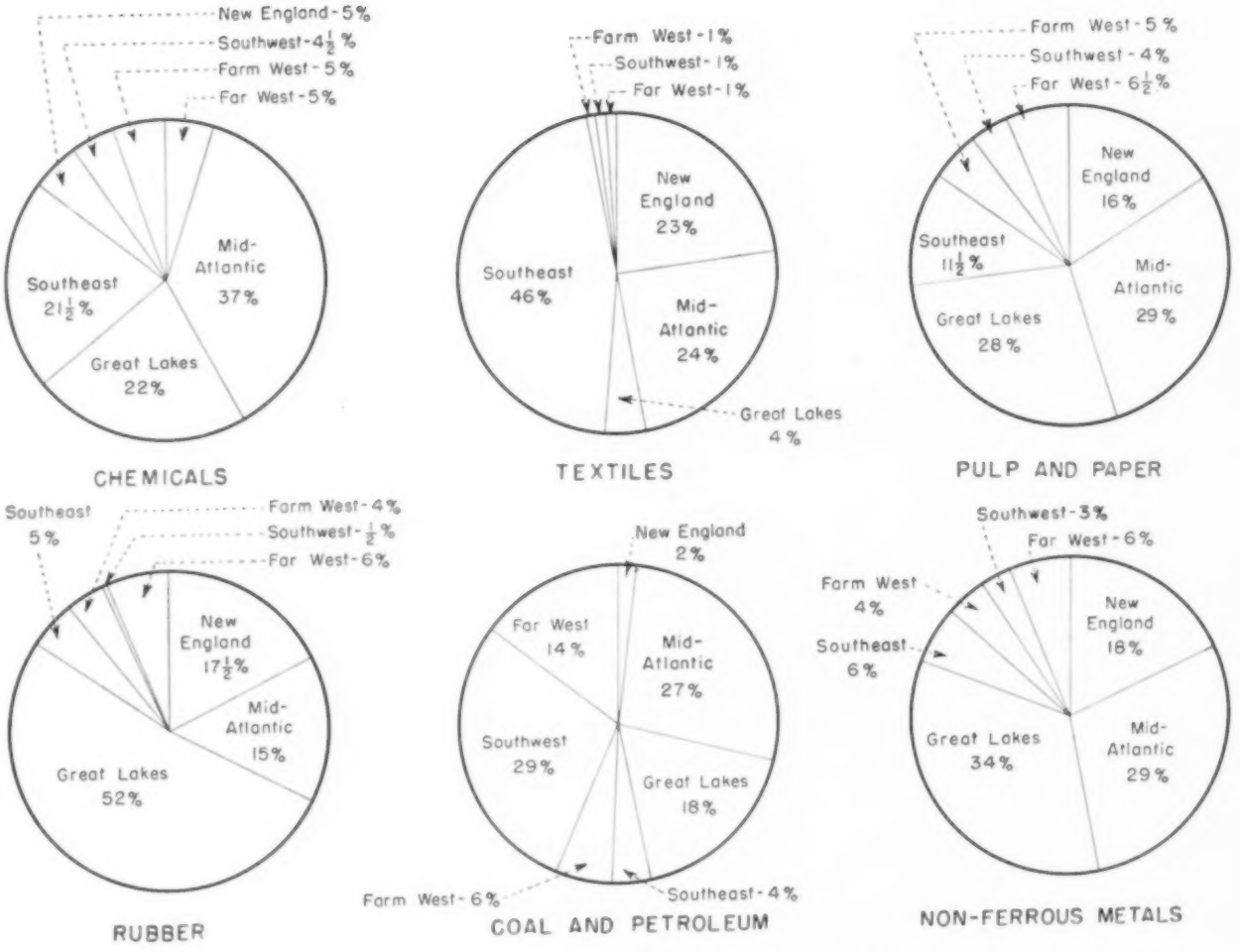
Wage differentials, on the other hand, show no such narrowing. Bureau of Labor Statistics studies show little change in average wage differences over the last 15 years. The Far

INDUSTRIAL DISTRIBUTION OF JOBS

In All Industries



In Specific Industries—1947



West still runs some 15 percent above, and the South some 15 percent below, par for the Northeast and Middle West. The biggest boon for the fast-growing regions, in labor matters, has probably come from the wartime training that built up skilled, efficient labor forces and so reduced relative costs.

Not all industries or regions are affected by these forces in the same way. They are, after all, only a few of the factors governing location of industry. But the trend toward more general migration—and the forces behind it—is unmistakable.

Migration, too, particularly in the broader pattern, has a way of feeding on itself. New automobile assembly plants, for example, may be located in Atlanta or Los Angeles because markets there are growing, trained labor is now available, parts suppliers have grown up in the area, and freight rates are changing favorably. But, once the plants are built, they themselves attract new makers of parts and supplies. And that enlarges the local or regional market for steel and other materials, for building materials and machine tools, and for the whole range of industrial equipment.

In years ahead a new emphasis may be given migration and decentralization as the U. S. prepares against the possibility of atomic warfare. But even without that incentive it is easy to predict that the new, more general migration, feeding on itself, will forge ahead for some years to come.

Regional Migration

Whatever the over-all trek of industry to the South and West from the Northeast, the story of what's happened is very different from area to area. First, it's a matter of which industries gained or lost in a region. Second is the question of how important each industry is to a region's total employment. Third factor is whether industries in which a region's stake may be high are growing fast or not. All of these and other influences are summarized here:

New England—This region's share of factory jobs has shrunk consistently for many years. It has again, since 1939, suffered the sharpest loss of any. Even its postwar industrial job total stands lower than it did in 1919. But nondurable lines have taken New England's worst declines recently. Its shares of U. S. totals increased in three of six metalworking industries. So, within this historically soft-goods region, durable goods are winning out. They account for three-fourths of the region's over-all job gains since '39. Should the long rumored move to build new seaboard steel mills in the region ever pan out, it would hasten this new trend.

Middle Atlantic—This top-ranking center went over the hill—in relative terms—decades ago. In line with its history, it took the second worst regional loss since '39. And with only 20 percent of the new plants, in contrast to its 30 percent share of existing employment, the region is tabled for further cuts in its over-all shares, even if its total industry continues to grow. Yet, Mid-Atlantic shares of the regional totals have risen in five manufacturing industries since 1939, and the region has held its own in two major specialties, apparel and miscellaneous products. So it's far from safe to push general trends into specific cases, even here.

Great Lakes—Until 1929—or even 1939—the heart of United States industrial growth, this region has begun to slip. Its shares have dropped in 14 of 20 industries. And its new construction runs below its present stake in manufacturing. Until now, the trend away from the Great Lakes has been slight but general. From now on, increasingly, the losses in regional shares will begin to appear in heavy goods industries like autos, machinery, and steel, in which the region boasts special concentration.

Southeast — The old South has forged ahead steadily in most lines over the years. But it has emphasized specialties, such as textiles and lumber, in which again it scored its biggest gains since '39. It moved up well but less sharply in food, paper, rubber, and a couple of other industries. But its growth has been only near-average in a good many other manufacturing lines. Possibly, the region's striking advances in income-per-person over the past ten or fifteen years will accelerate migration in other consumer products as well. But thus far, the Southeast allotment of new construction suggests that, overall, its industrial growth will continue the moderate pace it has shown historically.

Farm West—This region has taken a new lease on industrial life during and since the war. Historically, it's not had much above average growth, and after 1929 it even slipped back a little. Yet its job shares of the U. S. have advanced in 18 of 20 manufacturing lines since prewar days. Whereas food industries made up one-third of prewar factory jobs, they provided only one-sixth of '39-'47 job gains. Postwar construction indicates continued mild but general industrial advance.

Southwest — This is the United States' industrial infant—young and fastest growing. Lumber, food, and oil were its prewar big three, accounting for over half of all factory jobs. But, by advancing in almost every industry group, the region has diversified. And its expansion, through new plant construction, is running triple the nation's average pace. However, in many lines Southwest industry is exceedingly small—in half-a-dozen cases even less than one percent of the U. S. total.

Far West—Here is, in many ways, the nation's center of greatest growth. Gains in regional shares have been large and broad. And, while starting from a bigger industrial base, gains are running almost as sharp as in the Southwest. It's notable that postwar construction is running even faster than wartime building in the Far West. Where food and lumber made up almost half of '39 factory jobs, they provided only a fifth of '39-'47 expansion. Metals and chemicals—"war industries"—have almost trebled their jobs and now balance food and lumber. Other manufacturing has also made strides. Lumber was the only case where Far West shares of industry failed to advance.

Chemical Migration

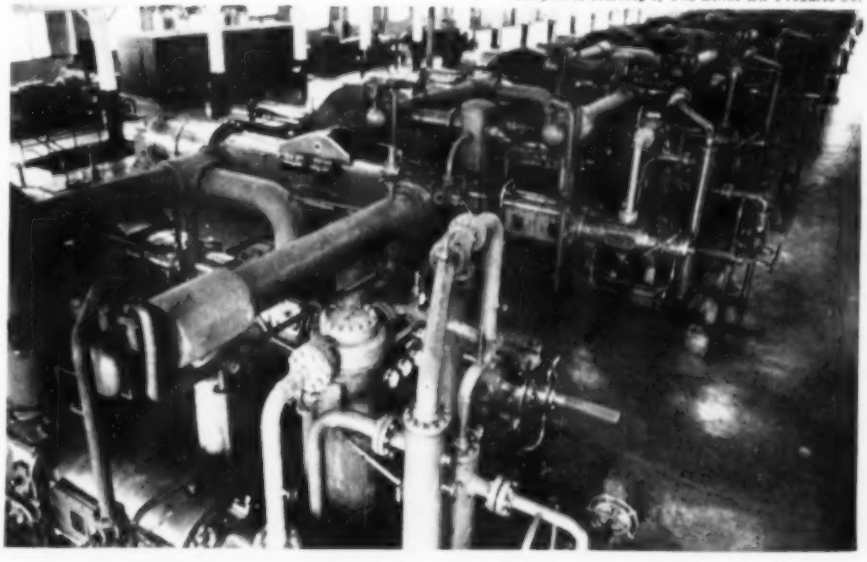
Story of migration differs a good deal among the industries. Some, like chemicals, have shifted only slightly; others, like rubber products, have moved a lot. Many have followed a general trend to the South and West, but others, like lumber and autos, show special patterns. In chemicals, growth dominates.

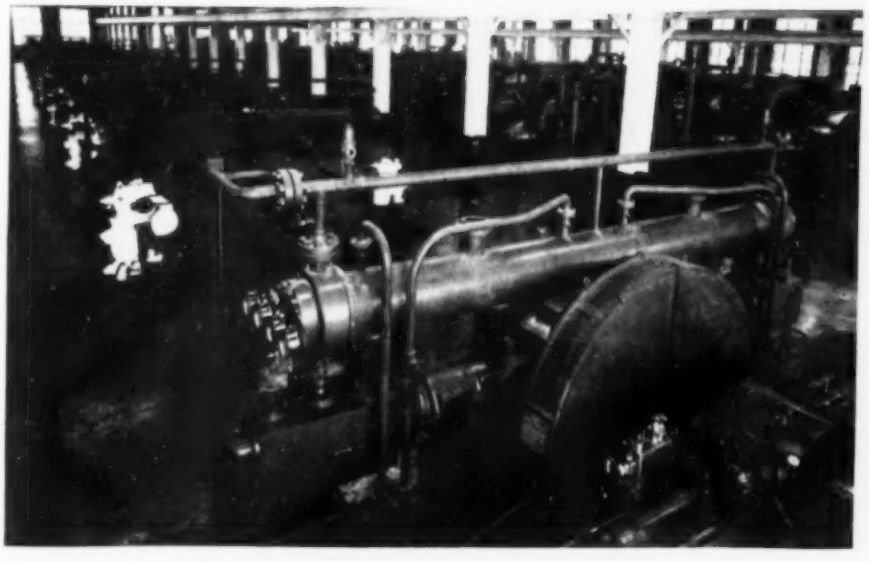
Chemicals' huge boom everywhere since prewar times far overshadows any "migration" of the industry so far. However, the large postwar expansion program, which puts great stress on "new" regions like the Southwest, is not reflected in '46-'47 employment data, on which this migration survey is based. Regional shares of chemical jobs have shifted only slightly since '39—a one percent Northeast loss, in Mid-Atlantic States, to the moderate gain of the South and West. In contrast, total industry jobs have doubled since '39. So the Mid-Atlantic still has 37 percent of the total, and the Great Lakes and Southeast 22 percent each; other regions' shares run around five percent each. Individual chemical lines —drugs, paints, rayon, fertilizers, soap, as well as industrial chemicals—have shown different growth and migration patterns; but growth dominates migration in all.

Impact of Tonnage Oxygen
On American Chemical Industry

"Tonnage oxygen," of 90 to 95 percent purity, is here experimentally and enormous plants for its production are building. Possibilities for use appear tremendous.

All photos courtesy of The Linde Air Products Co.





Compression and expansion equipment of this type, used in plants for making high-purity oxygen, will probably not be found in the new low-purity plants. The upper view shows four-stage, reciprocating, steam-driven compressors, each delivering about 250,000 cu. ft. of air per hour at 1,500 psi. pressure and 70 deg. F. The lower view shows reciprocating expanders which provide refrigeration and act also as the fifth stage of the compressors shown above, compressing the air from 1,500 to 2,000 psi. by absorbing energy from air being cooled.

Charles R. Downs
Consulting Chemical Engineer
New York, N. Y.

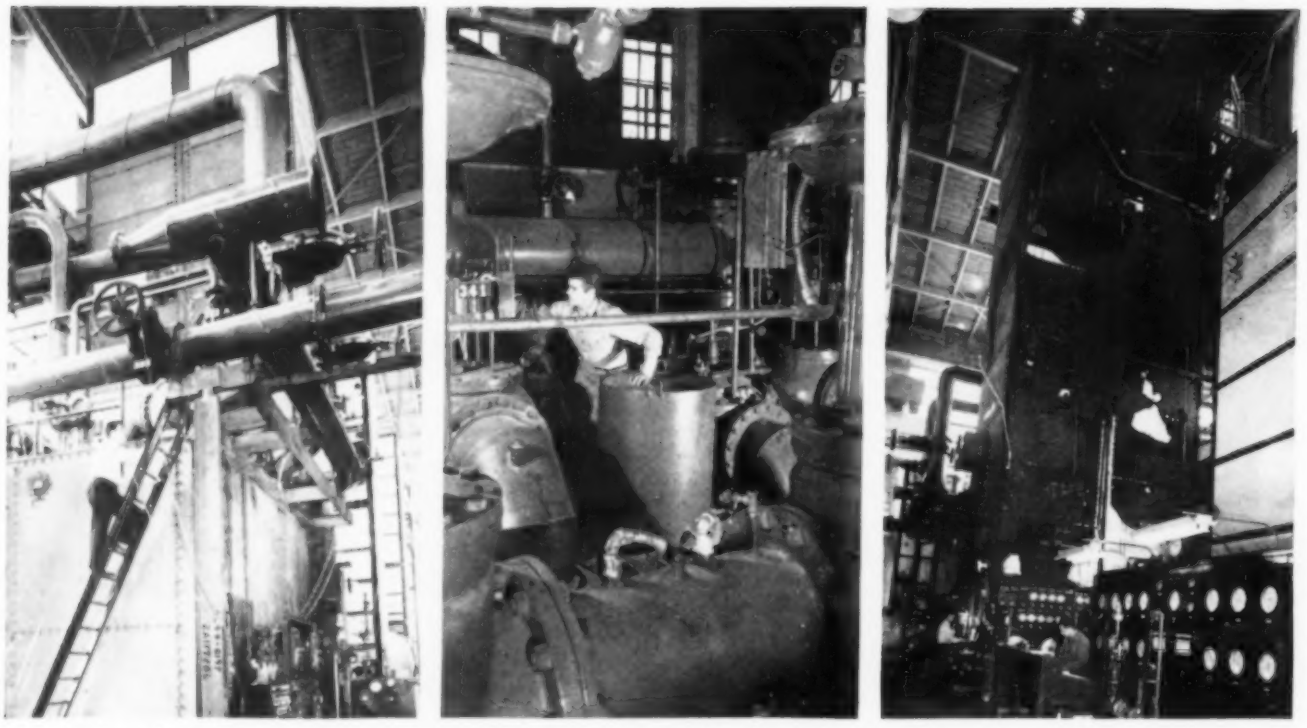
OXYGEN has long since been removed from the luxury class of Priestly's day and is used in large volume, chiefly as a tool for fabricating metals. In a less pure form it is now entering an era as a process raw material and for this purpose promises to be used in hitherto unheard of quantities. Referred to as "tonnage oxygen" to distinguish it from the high purity material, lower purity oxygen still has the status of a new raw material, so that to assess its impact on the chemical industry it is necessary in considerable part to resort to speculation.

Oxygen Production

Oxygen of 99.5 percent purity, presently used mostly for cutting and welding purposes, has been produced in this country for many years. The capacity of such plants today is usually from 2 to 10 tons per day, but a few have been built for as much as 150 tons per day in a single unit.

In general, the process consists of the following: Air is compressed to a pressure of 400 to 3,000 psi. in a reciprocating compressor, scrubbed with alkali for carbon dioxide removal, and dried with solid caustic potash. The clean air is passed into a heat exchanger, and then through a reciprocating expansion engine or a throttling valve for further cooling. In the expansion device, the air is usually partially liquefied, and the mixture of liquid and vapor is then

This article is slightly condensed from a paper presented on June 10 by the author before a meeting of the Chemical Market Research Association in New York.



These views, from the largest gaseous low-purity oxygen unit so far built, show at the left the heat exchangers and regenerators for purifying and cooling the incoming air; at the center, some of the valving and piping arrangements on top of the regenerator unit; and at the right the "cold box" in which the rectification and some of the heat exchange equipment is located. This unit, in Linde's East Chicago plant, produces about 4,800,000 cu. ft. (200 tons) of 90 percent oxygen per day and has been in operation for testing and research purposes for about a year.

passed into a double fractionating column, where the air is completely liquefied at about −275 deg. F. and separated into oxygen and nitrogen streams. These products leave the column as vapors at their dewpoint temperatures and at slightly above atmospheric pressure. They are finally heat exchanged with the entering air and leave the unit at atmospheric temperature. The oxygen is then compressed into cylinders at a pressure of about 2,200 psi.

In many installations, it has been found desirable to produce the oxygen as a liquid because of reduced distribution and handling costs. In this case, the oxygen is withdrawn directly from the column in liquid form into the containers. Such plants require several times as much power per ton of product as do gas-producing plants.

A tabulation given here shows the 99.5 percent oxygen produced in the United States since 1919, in rounded figures of billions of cubic feet per year. The interesting years to show the trend are 1919 at 1.17 billion cu. ft., 1929 at 3.14, 1933 at 1.82, 1941 at 7.18, 1943 (the maximum war year) at 20.48, 1946 at 10.87 (a reduction due largely to strikes in steel and coal production) and 1948 at the rate of about 15.5 billion cu. ft. per annum.

The delivered sales prices of oxygen for cutting and welding purposes (99.5 percent purity) within a short transportation radius may be assumed to be approximately $120 per ton for 10 tons per mo.; $77 per ton for 85 tons per mo.; and $64 per ton for 190 tons per mo.

For experimental purposes, which require large quantities of oxygen, prices have been reported to be as low as one half the last named figure. Such a price is however far above the cost of production of gaseous 95 percent oxygen in large plants.

Beginning about 1930 in Germany, plants were developed for the production of oxygen of lower purity (90-95 percent) on a much larger scale than formerly attempted. Such plants reached a capacity of 120 tons per day in a single unit, and this development has been continued in the United States where single units of about 1,000 tons per day are under construction. The term "tonnage oxygen" has been aptly applied to the product of such plants. The economies to be gained are the following:

1. In plants for the production of 99.5 percent purity, a large amount of power is consumed in supplying liquid reflux for the separation of argon from the oxygen. Air contains about 0.9 percent argon by volume, and the normal boiling points of oxygen and argon are only 3 deg. F. apart. With the lowering of the purity requirement of the oxygen to about 95 percent, this difficulty is relieved, resulting in a theoretical power saving of about 50 percent.

2. These large plants completely eliminate the use of chemicals for cleaning the air by using switching heat exchangers or regenerators to freeze out the impurities, and later subliming and purging the impurities with byproduct nitrogen.

3. The maximum pressure in such plants is about 85 psi., as compared with 400 to 3,000 psi. in previous plants. This represents a tremendous saving in compression power.

4. For plants of 100 tons daily capacity or greater, use is made of very efficient turbo-compressors rather than reciprocating compressors, resulting not only in a power saving but also in a large reduction in initial investment cost and space occupied by the compressors.

U. S. Production 99.5 Percent Oxygen, Billions of Cubic Feet per Year

1919	1.17	1937	4.44
1921	1.06	1939	4.56
1923	2.06	1941	7.18
1925	2.07	1942	14.99
1927	2.36	1943	20.48
1929	3.14	1944	18.74
1931	2.05	1945	13.93
1933	1.82	1946	10.87
1935	2.68	1947	13.77
		1948 (3 mos.)	15.5 rate

5. Finally, plants of this size make use of the recently developed turbo-expanders, replacing the relatively inefficient reciprocating expanders, or throttle valve cooling. This again represents a power saving for refrigeration of the plant.

Furthermore, with the installation of a tonnage oxygen plant, it is possible to take off a side stream of 99.5 percent purity for cutting and welding uses in the plant, with insignificant increase of power per ton of oxygen.

Capacity of Plants

The rated capacities of plants now being built, in tons per day of 90-95 percent O_2, are as follows:

1. For Bethlehem Steel Co., at Johnstown, Pa., for iron and steel production, about 150 tons per day.
2. For Carthage Hydrocol Co., at Brownsville, Texas, for the hydrocarbon synthesis process, about 2,000 tons per day.
3. For Stanolind Oil & Gas Co., near Garden City, Kansas, also for hydrocarbon synthesis, about 2,000 tons per day.
4. For McCarthy Chemical Co., at Winnie, Texas, for partial oxidation of hydrocarbons, about 175 tons per day.
5. For Weirton Steel Co., at Weirton, Pa., for iron and steel production, about 400 tons per day.
6. For E. I. du Pont de Nemours & Co., Ammonia Department, at Belle, W. Va., about 360 tons per day.
7. For Wheeling Steel Co., at Steubenville, Ohio, for iron and steel production, about 135 tons per day.

Note should be made that the Carthage Hydrocol and Stanolind plants each contain two units only, of 1000 tons per unit per day capacity, which are vastly larger than any units heretofore designed.

The estimated annual production capacity of the seven plants now building is 5,220 tons per day or 40 billion cu. ft. per year of 90-95 percent oxygen. This is in contrast to the 15½ billion cu. ft. which is the present rate of production of 99.5 percent O_2 and 20½ billion cu. ft., the peak war year production. Thus the estimated production of 90-95 percent oxygen from these seven plants will be about twice the tonnage of all plants in operation at the peak of the war.

The composition of 95 percent oxygen by volume is approximately 95.0 percent oxygen, 3.2 percent argon and 1.8 percent nitrogen. The purity of the nitrogen varies from 98 percent to almost 100 percent depending upon the type of system used. Some plants can produce a nitrogen stream of 99.9 percent purity without difficulty, but others require special equipment for this purpose. In all cases the major impurity is oxygen as well as small amounts of water and carbon dioxide when using nitrogen for clean-up of the heat exchangers. By one system about 75 percent of the nitrogen discharged from the plant is practically 100 percent pure.

Since potential uses of tonnage oxygen will depend on the cost of production as compared with the benefits to be derived over using air, it is necessary to attempt to predict both plant investment and total operating cost. This is necessarily tentative owing to the improvements that can be expected as well as present uncertainties in future construction cost. Also differences in use and in local factors make a special study of each particular case necessary. However, as a guide, an accompanying table gives estimated plant investment and operating costs for 100 and for 1,000 ton per day plants, assuming a turnkey installation complete in every way except for the inclusion of steam and power generation facilities. It is assumed instead that these utilities will be brought to the site. Distribution of utilities within the plant is provided for, however. Costs of plants of intermediate size may be assumed to lie on a straight line plotted between the tabulated costs on logarithmic paper.

In the tabulation no credit has been allowed for the nitrogen produced, part of which may be useful in certain operations such as steel and refineries.

It should be noted that the maintenance and fixed charges, especially on the smaller plant, are a major cost factor, namely $4.33 out of a total cost of $7.02 per ton with 10-year amortization.

Power, whether from steam or electricity, should include all that consumed in the plant. However, hydrocarbon synthesis and other exothermic processes generate large amounts of high temperature heat which, converted into power, makes possible an appreciable saving in this cost item.

Estimated Plant and Operating Costs for Tonnage Oxygen Units

	Plant Capacity	
	100 Tons per Day	1,000 Tons per Day
Estimated unit costs...	$1,000,000	$4,000,000
	Per Ton	
Operating cost		
Steam[1].....	$1.56	$1.46
Electricity[2].....	0.11	0.11
Water[3].....	0.35	0.30
Labor[4].....	0.67	0.07
Maintenance[5].....	0.72	0.29
Fixed charges[6].....	3.61	1.44
Total operating cost...	$7.02	$3.67

[1] Steam is assumed to be the principal source of power at $0.30 per 1,000 lb.

[2] Electricity will undoubtedly be used for driving small pumps and other accessories at $0.005 per kwh.

[3] Water for miscellaneous cooling purposes and for a barometric condenser for steam turbines at $0.01 per 1,000 gal.

[4] Operating labor at $67 per operating day for each plant.

[5] Maintenance at 2½ percent of plant cost based on 346 operating days per year.

[6] Fixed charges at 12½ percent of plant cost based upon 346 operating days per year, including 10 percent for amortization and 2½ percent for taxes, insurance, etc.

Synthetic Liquid Fuels

There are two principal processes used to make synthetic liquid fuels, both of which require low cost oxygen. These are the Bergius and the hydrocarbon synthesis processes.

The Bergius process consists in hydrogenating coal at very high pressures, while in suspension in an oil, to liquefy the coal. The hydrogen is produced from coal by reacting it with oxygen and steam. Under certain favorable economic conditions the hydrogen can be produced from natural gas. The Bergius process is not considered herein because no oxygenated chemical byproducts are formed. It is rumored that mild hydrogenation of coal may be used to produce aromatic hydrocarbons.

The hydrocarbon synthesis process is also called Synthine, Hydrocol and Synthol. These processes as developed in the United States include improvements of major importance over the German Fischer-Tropsch process. In these a "synthesis gas" is used, comprising mixtures of carbon monoxide and hydrogen, made from oxygen and carbon-containing materials such as natural gas, coal and possibly heavy petroleum residues. At present the catalysts used give substantial yields of oxygenated organic chemical byproducts.

The prewar consumption of petroleum was 3.5 million bbl. per day and in 1948 is running almost 5.5 million bbl. per day. The peace time normal annual growth in demand for petroleum is projected as 200,000 bbl. per day, which means that one year from now the daily consumption is expected to be 200,000 bbl. per day more than at present. At this rate, by 1958 total use would be about 7.5 million bbl. per day. It is estimated that a future war will need 2 million bbl. per day which would require rationing of petroleum to limit its use for domestic purposes. It is the con-

census that an adequate supply of petroleum per year, 10 years hence, whether for peace or for war, cannot be met from United States wells or even from the Western Hemisphere. It can be satisfied by imports from the near East, but this source is unsafe for national defense. The question is, can the expected deficit of 2 million bbl. per day be supplied by synthesis on any economic basis?

There have been many estimates made of the cost of plants to produce gasoline and distillates from petroleum on the one hand and from natural gas and coal by hydrocarbon synthesis on the other. They vary by wide margins depending upon what facilities are included in the plant cost. Current estimates of plant costs per bbl. per day for the *maximum* yield of premium gasoline, which appear to be as accurate as possible for comparative purposes are: From petroleum, $6,500; from natural gas, $8,200; and from coal, $8,500 per bbl. per day of gasoline.

Estimated Production Costs

The same sources estimate the cost of producing premium gasoline, including 5 percent amortization and 10 percent return on the investment as capital charges, as follows: From petroleum at $2.78 per bbl., 14.1c. per gal.; from natural gas at 10c. per 1,000 cu. ft., 12.8c. per gal.; and from coal at $3.20 per ton, 16.6c. per gal.

The premium gasoline to be produced by the three processes is assumed to be suitable for use in engines at a 10 to 1 compression ratio because by the time a large number of synthetic plants are in operation such engines are expected to be in common use.

The plant and operating costs indicate that natural gas, at least, is competitive with crude oil for the production of *maximum* yields of premium gasoline, at the assumed values of the raw materials, whereas synthesis from coal will be more costly. Thus we can expect that oxygenated byproducts will be available in the not distant future in large quantities. It is pointed out, however, that the state of the art and the enormous requirements for steel do not justify building a large number of plants until those now being installed provide the necessary data.

It is estimated that enough gas, in sufficiently concentrated areas and at a low enough cost, will be available to justify the building of not more than 30 hydrocarbon synthesis plants each producing 7,500 bbl. per day or a total of 225,000 bbl. per day of liquid fuels. A smaller number of larger plants will probably be built. Assuming that the production of liquid fuels from natural gas is limited to about 225,000 bbl. per day, ultimate reliance must be based upon coal, which we have in abundance, if we are to satisfy even a portion of the indicated deficit of 2 million bbl. per day 10 years hence by this process.

Oxygenated Byproducts

The oxygenated organic chemical byproducts made by the hydrocarbon synthesis process are produced as complicated mixtures. The water soluble portion contains the C_1 to C_5 alcohols, the C_3 to C_6 ketones, the C_2 to C_4 aldehydes and the C_2 to C_4 acids. These will be the first products to be recovered. The products appearing in the oil stream are the C_6 to C_{12} oxygenated compounds. Ultimately these may be recovered.

The separation of the water-soluble compounds is difficult and requires an expensive plant to produce them to comply with existing purity specifications. But there appears to be little doubt that this objective can be attained, at least with the more important products, in the two plants now being built.

A total of 30 plants each producing 7,500 bbl. per day of liquid fuels from natural gas alone can make about 4 to 5 billion lb. per annum of the water soluble byproducts and yet this quantity would be derived from only 11 percent of the predicted deficit of 2 million bbl. per day of liquid fuels. What could be done with several times 4 to 5 billion lb.? It would appear that profitable disposal must be found for all of them, otherwise the processing cost must be charged to a few. They cannot be thrown away. They might be cracked to fuel at a cost but not much credit would accrue thereby to the liquid fuels. The alcohols, for example, might be used as gasoline constituents or mixtures employed as solvents. It is beyond the purview of this paper to suggest a solution of this problem, but it poses a real challenge to industry.

Note should be made that low cost oxygen may play an important part in the production of synthesis gases with varying proportions of carbon monoxide and hydrogen to be used purposely to form many organic compounds. Aldehydes and ketones by the O.X.O. synthesis, and oxygenated compounds, such as higher boiling alcohols, are examples. Low cost oxygen may also find important applications for the direct partial oxidation of many hydrocarbons as distinct from its use in the hydrocarbon synthesis process.

Underground gasification of coal has received a great deal of publicity as a source of fuel gas and synthesi gas. A test run was made at Gorgas Ala., using air. Oxygen was also used for a few hours. A more extensive run is now being planned. In my opinion the process is scarcely suitable for the production of synthesis gas and thus will play a small part, if any, in the production of chemical products.

It should be noted that the production of liquid fuel from oil shale shows promise but air is undoubtedly preferable to oxygen and byproducts useful for the chemical industry will not be made.

Iron and Steel

Much work was done in Germany on the use of oxygen-enriched air in blast furnaces for production of pig iron, ferro manganese and other ferro alloys. Such processes are complicated by characteristics of the ore and the economic conditions of particular countries but the German work has still stimulated intensive interest here. The first full scale installation will be started soon by Bethlehem Steel Co. at Johnstown, Pa., for the purpose of securing data on output, raw materials requirements and the effect on refractories. Initially the blast will probably contain 26 to 28 percent O_2. It is likely that blast furnaces may ultimately undergo major changes in design to obtain best results with oxygen-enriched air. Since higher temperatures can easily be attained with oxygen, enriched blast may be especially suitable for ferro alloys.

At least two dozen United States steel companies have been reported investigating the use of low cost oxygen in open hearth furnaces, with increase in output per furnace of 35 to 45 percent and decreased fuel consumption of as much as 20 to 25 percent. It appears that the advantages of oxygen in the open hearth are of sufficient importance to assure widespread adoption. In the case of the Bessemer converter, oxygen-enriched blast greatly reduces blowing time and permits the addition of a greater ratio of scrap to hot metal. It is predicted that by moderate alterations high quality steel can be made in the Bessemer which, because it needs no fuel and has greater capacity than the open hearth, may thereby tend to displace the latter.

How these steel industry possibilities may affect the chemical industry is of interest to us here. In the case

of the blast furnace, while there may be a reduction in coke per ton of iron of as much as 6 to 10 percent, the projected capacity increase of 22 to 26 percent that may follow from the use of an enriched blast should make a greater iron output possible and thus result in no decrease in the coal tar and light oil that would be available. Reduction in fuel requirements for the open hearth through use of oxygen would again seem not to affect the chemical industry adversely, and might so decrease the need for coal tar for open hearth fuel as to leave more coke oven byproducts for other purposes. At the same time, any tendency to substitute the Bessemer for the open hearth would also increase the oven byproducts available for chemical industry and other uses. The conclusion is, then, that use of oxygen in the steel industry will not reduce the quantity of coal tar aromatics available to the chemical industry below the present supply and that fluctuations in steel industry activity will exert more influence on the supply than will the impact of tonnage oxygen.

Sulphide Ores

The sulphide ores of copper, nickel, zinc and lead are smelted in reverberatories, converters, roasters and blast furnaces of various types using air to oxidize them to sulphur dioxide, which is diluted with nitrogen. In many instances the sulphur dioxide content of the gases is too low for profitable conversion to sulphuric acid and so is wasted. However, a moderate enrichment of the air blast with oxygen would make the sulphur dioxide content sufficiently high for the recovery of sulphuric acid in existing types of catalytic converters or lead chambers.

Nitrogen in the burner gases also increases the investment in scrubbing equipment for recovering sulphuric acid or oleum. The use of oxygen could reduce the nitrogen or eliminate it entirely. However, reduction in nitrogen, which functions as a heat-removing medium, would have to be offset by some other means of extracting heat to hold the desired temperature levels.

Many sulphide ore roasting operations are far removed from sulphuric acid markets where freight cost prevents profitable acid sale. Here the sulphides could be burned in powdered form with oxygen, producing strong sulphur dioxide and permitting the recovery of liquid SO_2 for shipment in tank cars. For longer freight hauls the weight of the product could be reduced further by converting the SO_2 to elemental sulphur. Investigations are being conducted by metallurgical and chemical companies along these lines and encouraging results are being reported.

City Gas

Manufactured city gas is made in the United States chiefly by the carbonization of bituminous coal in by-product coke ovens and the coke converted into water gas which is then enriched by carburetion with petroleum oils. Coal tar is recovered from the coke oven gas and water gas tar from the carbureted water gas process. Coal gas is frequently mixed with carbureted water gas and to the mixture at times is added low pressure gas containing butane and propane, natural gas or reformed natural gas to enrich it or to satisfy peak demands.

Oxygen may be used in the future for making water gas and for reforming natural gas. Neither process will affect the supply of aromatic hydrocarbons for the chemical industry.

Several methods have been developed in Germany for the complete gasification of coal. It is believed that none of them without extensive modification are suitable for making city gas in this country.

The Lurgi high pressure plants in Germany gasify lumps or briquettes of brown coal, which are fed continuously into fixed bed generators operating at about 300 psi. Oxygen and steam are injected to gasify the coal completely and the ash is withdrawn continuously from the bottom grates. The gas after the low temperature light oil and tar are condensed contains a large amount of CO_2. It is washed with water without reducing the pressure and most of the CO_2 is removed. The composition of the washed gas is reported as follows: CO_2, 1 to 8 percent; CO, 18 to 26; H_2, 51 to 55; and CH_4, 16 to 21 percent; the Btu. is 400 to 480.

If the light oil and tar are used for carbureting the washed gas its heating value may be increased to at least equal to our heating standards.

Brown coal does not cake while being carbonized. In this respect it is similar to lignite, but our lignite deposits are geographically remote. Anthracite silt is being considered within its restricted area. The bituminous coals which are located close to most large manufactured gas consuming areas in this country are caking coals and cannot be gasified in Lurgi-type generators without alteration. Several methods have been suggested to overcome this difficulty.

One method would be to carbonize the coal first, producing light oil and tar, and then gasify the lump coke in a Lurgi generator. Such a process, if it requires two separate steps, is not likely to be adopted. Moreover for this purpose the coke should be highly reactive, such as a char obtained by low temperature carbonization which produces tars of reduced aromatic character.

A second method would be to feed small sized bituminous coal continuously into a fluidized bed of fine coal ash, thereby dispersing the raw coal to prevent it from coalescing. The bed would be subjected to a stream of oxygen and superheated steam to gasify the coal completely and the ash would be withdrawn continuously. It seems to be technically feasible to operate such a process under pressure to produce a gas rich in methane. The principal difficulty is the construction of very large generators for 300 psi.

A third method is to gasify powdered coal completely while suspended in a stream of oxygen and steam in a combustion chamber of relatively small size, which would more easily be constructed to withstand high pressures. The cost of pulverizing coal is an important factor.

Numerous other methods have been proposed which indicates the interest in the subject.

The process ultimately found to be most acceptable may well combine the production of city gas and liquid fuels. For example a high methane gas of approximately Lurgi composition would be produced directly from coal in some form of high pressure complete gasification generator using steam and oxygen. This gas could be sold partly as city gas and the rest reacted with more oxygen to form synthesis gas. The latter would be converted into liquid fuels and a high Btu. gas which could be used to enrich the city gas to any required degree. The ratio of city gas to liquid fuels could be varied to suit local or seasonal demands.

Should this general objective be attained it is possible that coke ovens for making city gas might become obsolete. Then the supply of coal tar from this source would cease. Any such result is of course for the distant future because even the pilot plant tests have not yet been conducted.

Chlorine Production

Consumption of chlorine in the United States is out of balance with the use of caustic soda and the im-

(*Continued on page 121*)

Application and Design of MIXING EQUIPMENT

By use of data given in this article and an earlier article by the author, one can now determine the best type, size and speed of mixer for many mixing applications.

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AVAILABLE DATA for practical application and design of industrial mixing equipment are very incomplete. Most of the published information deals with individual types of equipment or with specific problems. It is the purpose of this paper to provide correlated data on this subject, that may readily be applied to the design of a great many mixing equipment applications.

The mixing of fluid materials may be divided into several classes, including: (1) Mixing of soluble liquids; (2) mixing of insoluble liquids; (3) mixing of liquids with soluble solids; (4) mixing of liquids with insoluble solids; and (5) mixing of liquids with gases or vapors.

In addition to this basic classification there are a number of factors that affect the solution of each problem, including viscosity and density of the fluids, as well as the aggregate state and the density of the solids, and the quantities of the materials involved. In the case of Class 1 above, mild agitation is sufficient except when the duration of the mixing operation must be shortened. For Class 2 violent agitation is required in most cases. For Class 3, when the quantity of soluble solids is relatively small, and the solids tend to settle slowly, mild agitation is sufficient unless the duration of the process must be shortened; when the quantity of solids is considerable, medium or violent agitation will be necessary. When the solids are heavy, tending to settle rapidly, violent agitation must be applied. The situation for Class 4 is the same as Class 3. With Class 5 violent agitation is practically always required.

When designing a mixing device for a certain application, a rational step-by-step procedure is advisable. As stated in the article, Simplified Approach to Mixing Problems (H. E. Serner, *Chem. & Met.*, Jan. 1948, p. 127), the total power required for a given job should first be determined, so that the magnitude of the problem may become fully apparent. This is a most important step. When, for instance, light liquids are concerned (such as water), the agitation of a very large quantity can be accomplished with relatively little power, whereas in the case of very viscous materials, even the agitation of limited quantities will require considerable power, and when materials of high density are to be handled the power requirement will increase in direct proportion to the density.

It becomes clear at the start that in order to solve a mixing problem, the evident and practical limitations of the size and shape of the mixing vessel must be considered. In the design of process plants and equipment, shape and size of mixing vessels are frequently decided on without consideration of the natural limitations imposed by the physical characteristics of the materials involved. When this is the case the designer frequently faces subsequent difficulties in providing mixing equipment suitable for the job. While these difficulties can be overcome in most cases, the final installation will frequently be more costly than necessary, and the mixing operation may not proceed as simply, smoothly and economically as had been expected.

After power requirements, size and shape of the vessel have been preliminarily approximated, the designer should choose the agitating device most suitable for his purpose. In order to make this choice he must be familiar with the specific advantages and disadvantages of the various types of agitating equipment, as well as their limitations. Unfortunately, the various types of agitators overlap in their scope of application, and for this reason it is not possible to state that one certain type of agitator should be chosen for a certain type of work. It is therefore best to consider each type individually.

There are three basic types of agitators: paddles, turbines and propellers. While there are countless varieties of mixing equipment in existence, most of them are combinations or variations of the three above mentioned basic types. It is also well to consider that they are agitating devices and not really mixing devices. The function of the agitator is to set in motion the fluid materials that are to be mixed, and mixing will be accomplished largely as a result of the agitation so produced.

The Paddle

The simple, horizontal paddle, revolving around a central shaft, is perhaps the oldest mechanical mixing device. It operates economically at slow speed, but the power requirements rise very rapidly as the speed is increased. For this reason the paddle type agitator should be considered only when mild or medium agitation is required. When a more vigorous degree of agitation is called for, other types of equipment should be used. The velocity of the paddle tips must always be moderate irrespective of the total paddle length, and as the viscosity increases slower speeds must be applied.

The paddle, when used in a cylindrical tank, causes the fluid content to flow in a circular motion. Since the paddle always travels faster than the liquid, it cuts through the liquid with a shearing action constantly changing the relationship of the horizontal layers of liquid in the tank. Two or more

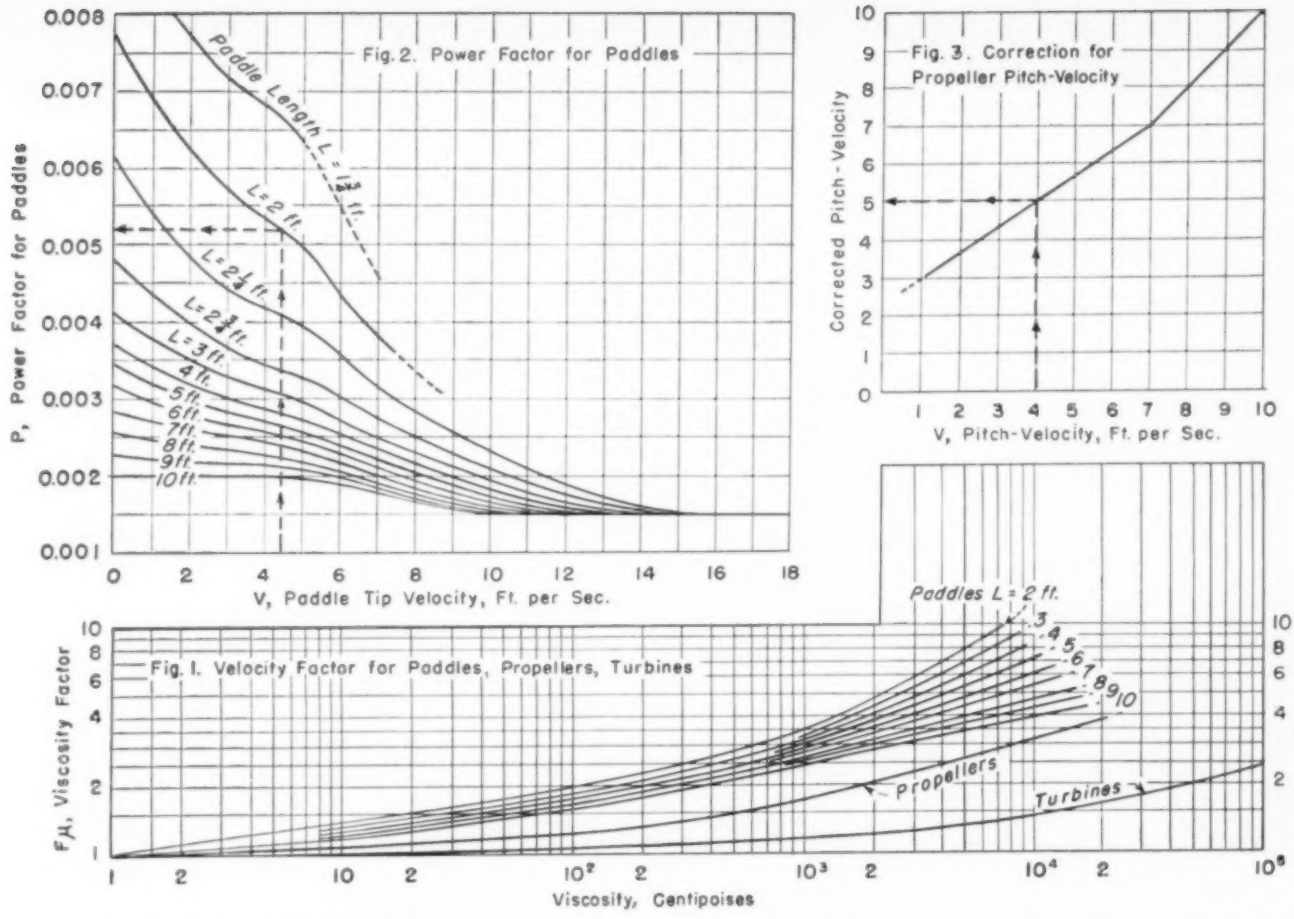


Fig. 1—Viscosity factors for calculating power requirements for paddles, turbines and propellers by Equations 1, 2 and 3.

Fig. 2—Power factors for calculating power requirements for paddle agitators by means of Equation 1.

Fig. 3—Pitch velocity corrections for three-bladed propellers, used in Equation 3 when pitch velocity is under 7 fps.

paddles, mounted on a central vertical shaft, are used in most applications. The paddle blades are usually tilted at an angle of 45 deg., adding an upward or downward motion to the liquid. The direction of the paddle-pitch is often alternated, but the paddle nearest the bottom of the tank is usually so tilted that it will cause an upward motion of the liquid.

Paddle agitators are well suited for mild and medium agitation, including the mixing of miscible liquids of similar densities; the mixing of liquids with soluble solids; and the mixing of liquids with insoluble solids that do not tend to settle rapidly. Paddle agitators are, as a rule, not applicable for the violent agitation involved in mixing of liquids that are not miscible; the mixing of liquids having greatly varying densities; or the mixing of liquids with solids that end to settle rapidly.

Since paddle agitators are economical only for slow speed agitation, they can only be used to good advantage in vertical, cylindrical vessels with a central agitator shaft. It is common practice to make the overall length of the paddle only slightly shorter than the inside diameter of the tank. As noted this arrangement gives the liquid in the tank a circular motion. Since the speed with which a mixing operation can be performed depends on the number of shear planes created within the liquid mass, the mixing action of such a simple paddle arrangement is bound to be relatively slow because, first, the motion will be slow, and second, few shear planes will be produced in the liquid as the paddles pass through it.

In order to increase the mixing effect of a paddle agitator, it is necessary to increase the turbulence and create more shear planes in the liquid. This can be accomplished by providing a number of vertical baffles on the inside of the cylindrical tank shell. Such a baffle arrangement will change the simple circular motion of the liquid into a predominantly vertical circulation with the addition of eddy currents around the tank baffles, thereby increasing the mixing effect of the apparatus; but in order to operate the paddles at the same speed, about 50 percent more power will be required, and mixing time will be reduced about 50 percent. The number of vertical baffles to be used in a tank should be about one for every foot of tank diameter. Except in very small tanks, they should not be spaced less than 3 ft. and not more than 4 ft. apart on the tank circumference. The width of the baffle should be approximately 10 percent of the tank radius. The velocity of the paddle tips should not exceed 600 fpm., irrespective of the length of the paddle. A paddle speed of 25 rpm. is about normal for a 6 ft. diameter tank and thin liquid.

In order to determine the power required for the operation of a single paddle, the following empirical equation may be used:

$$Hp. = P\,V^2 F_\mu S\,T \qquad (1)$$

where $Hp.$ = horsepower consumed; F_μ = viscosity factor (see Fig. 1); P = power factor (see Fig. 2); V = paddle-tip velocity, ft. per sec. = $(L\pi N)/60$; L = overall length of paddle, ft.; N = number of revolutions per minute; S = specific gravity; T = tank factor = $D/(L + 1)$ (for explanation see below); and D = tank diameter, ft. The width of the paddle blades is 7 to 10 percent of L. The total power required for a paddle agitator having two or more paddles is:

$$Hp. = (P\ V^3\ F_\mu\ S\ T) \times (\text{Number of paddles}) \times 0.7 \qquad (1a)$$

The above method is based on operation in a tank having a diameter 1 ft. greater than the overall length of the paddle. The power requirement will increase in direct proportion to the tank diameter: a 4-ft. paddle, requiring 5 hp. when operated in a 5-ft. diameter tank at a certain speed, will require 10 hp. when operated at the same speed in a 10-ft. diameter tank. This is caused by the fact that the velocity of the liquid in a larger tank will be slower, and the paddle will have to pass through the liquid at a higher relative velocity. The tank factor in the above cited case is 2 or: $D/(L + 1) = 10/(4 + 1) = 2$.

The Turbine

The turbine is a most effective agitating device, especially when violent agitation is desired. It can be employed effectively to produce any degree of agitation. It is well adapted to the mixing of heavy and/or viscous liquids. It can be operated economically at reasonably high velocities and can, therefore, be used to impart high velocities to the liquid without excessive power consumption. It is well adapted for: (1) Mixing of liquids having greatly different densities; (2) mixing of liquids with heavy solids; and (3) mixing operations in which high turbulence and liquid velocities are needed.

The most common agitator turbine is the so-called curved-blade type. Straight-blade turbines are seldom used since their operation is less efficient than that of the curved-blade type. Another type frequently found is the pitched-blade turbine. This turbine has straight blades that are usually set at a 45 deg. angle to the plane of rotation.

The turbine is nearly always used in vertical, cylindrical vessels. The type of circulation which it creates is very similar to that of the paddle agitator, whereas the action of the turbine itself is quite different. In operation the turbine discharges a stream of liquid in a more or less tangential direction from its entire periphery, and at the same time creates a strong suction near its center. It is therefore evident that while a turbine in a circular tank creates a circular motion of the surrounding liquid, it also produces due to its suction a strong up and down flow of liquid. A very complex type of circulation with numerous shear planes is created, resulting in a highly effective mixing action. While no rule-of-thumb methods exist for dimensioning turbines, in a majority of applications the diameter of the turbine is between one-third and one-half of the tank diameter. Two or more turbines are often used on one shaft, especially in cases where the height of the tank is great with respect to its diameter.

In order to increase further the mixing effect of turbine agitators, vertical tank baffles are often used. Their action is similar to that described in connection with paddle agitators, except that the placing of baffles in a tank agitated with turbines does not appreciably increase the power input required to drive the turbine at the same speed. The turbine may also be surrounded by a set of stationary deflector baffles which change the tangential discharge direction of the liquid to a radial direction. The effect on the circulation in the tank is much the same as that of vertical tank baffles, but the resultant tank obstruction is not desirable from the viewpoint of maintenance. Like the paddle agitator the turbine is limited with regard to its maximum economical speed, except on a much higher speed level. Depending on their diameters, turbine agitators are usually operated slower than the standard electric motor speeds, seldom exceeding a peripheral velocity of 1,600 fpm.

Owing to the relative size and weight of turbines, their driving shafts, like those of the paddle agitators, require end-bearing (step bearings at the bottom of the vertical tank) except in rare cases when the agitator shaft is exceptionally short.

In order to determine the power required by a curved blade turbine, the following equation may be used:

$$Hp. = 0.00176\ V_e^3\ A_e\ F_\mu\ S \qquad (2)^*$$

where $Hp.$ = horsepower consumed; F_μ = viscosity factor (see Fig. 1); V_e = effective velocity, fps. = $0.73\ (D\pi N)/60$; A_e = effective area, sq. ft. = $0.67\ (D\pi B)$; S = specific gravity; N = number of revolutions per minute; D = turbine diameter, ft.; and B = turbine width, ft.

The action of the pitched-blade turbine is a combination of turbine action and propeller action. While it discharges liquid more or less tangentially on its periphery, it also moves a large stream of liquid in an axial direction. This turbine is often used for the suspension of solids, and is then usually placed near the bottom of a vertical, cylindrical vessel. The power consumption of pitched-blade turbines may be assumed as slightly higher than that of similar curved-blade turbines.

The Propeller

Use of the conventional ship propeller as an agitating and mixing device is more recent. Before the advent of individually driven equipment, when agitating and mixing devices were usually driven from overhead lineshafts, the propeller was not much employed owing to its relatively high speed of operation. Small propellers can be operated at full motor speeds, and even the largest propellers generally in use for agitating purposes (30 in. dia.) are operated at relatively high speeds (350 to 400 rpm.). The propeller is a very effective agitating device. It can be used in liquids having viscosities up to about 10,000 centipoises. Its greatest effectiveness, however, is in the lower ranges of viscosity. It is also well adapted for dissolving of solids in liquids, and for suspensions.

The propeller produces a cylindrical stream of liquid at high velocity and parallel to the propeller shaft, with a secondary helical flow within the stream. In this stream, due to its complex flow pattern, exist many shear planes, which explains the efficient mixing action of propellers. The one-directional flow created by the propeller is deflected by the walls of the mixing vessel, and it is therefore evident that the resultant mixing action depends on the size and shape of the vessel, as well as the proper position of the propeller. In liquids of low viscosity such as water, gasoline, etc., small propellers can be operated at very high speeds (1,750 rpm.) but the higher the viscosity of the liquid, and the larger the diameter of the propeller, the slower must be the speed; otherwise cavitation may occur, which means that the propeller will merely churn in the liquid without causing it to flow. Sometimes the pitch of the propeller is reduced, which in turn reduces the power consumption at a give rpm. The propeller is a very adaptable device. It is effectively used for the mixing of liquids in small laboratory vessels, as well as in very large gasoline blending tanks (100,000 bbl.) where none of the other conventional agitating devices is practical.

Propeller agitators, ranging in size up to 1½ hp., are made as portable units that can be conveniently used in open top tanks and are usually clamped to the side of the mixing vessel. Units of 2 hp. are available, but

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* Eqs. 2 and 3 have been derived as follows:

$$Hp. = (Gpm. \times VH)/1,718.64$$
$$Gpm. = A \times V \times 60 \times 7.48$$
$$VH = (V^2\rho)/(2g \times 144) = 0.00673\ V^2 S$$
$$\therefore Hp. = V^3\ A\ S \times 0.00176$$

Here $Hp.$ = horsepower consumed; $Gpm.$ = gallons per min.; VH = velocity head, psi.; A = liquid discharge area, sq. ft.; V = liquid discharge velocity, fps.; g = acceleration due to gravity, 32.2 fps., per sec.; ρ = liquid density, lb. per cu. ft.; and S = liquid specific gravity. The application of this basic equation requires the proper determination of the effective liquid discharge area and velocity for either turbine or propeller.

they are too heavy to be conveniently handled by one operator. Portable propeller agitators are made with either a single propeller or two propellers on one shaft. The reason for using either one propeller or two propellers is frequently not fully understood by the user. When a mixing job is to be done it makes little difference how the required agitation is imparted to the liquid. When the liquid is of low viscosity a single propeller of the proper size and speed is entirely adequate to do the job. If, in such a case, two propellers were used on one shaft consuming together the same amount of power, there would perhaps be a small improvement in the mixing action, but in terms of "time elapsed" the improvement would be negligible. However, when the mixing of very viscous materials is to be effected, a single propeller will frequently not be satisfactory. There enters a condition which up to now has received little attention. This condition is "effective radius of agitation."

For example, if a very light liquid such as water or gasoline were to be agitated in a very large tank, all of the liquid would eventually be set in motion even if a very small agitator were to be used. As the viscosity of the liquid is increased, its ability to flow becomes more limited and eventually a point is reached where the flow created by the agitator will be reduced to a certain distance from the agitator and beyond this distance the liquid will remain motionless. It is for this season that two propellers are often used for the agitation of very viscous materials, so that the two spheres of agitation produced by the two propellers will extend throughout the confines of the mixing vessel.

The effective radius of agitation in any liquid is a function of the velocity at which the liquid is discharged from the agitator, and the liquid mass that is being discharged. There is not much information available on this subject. Some individual cases have been studied, but the data obtained have not yet been correlated and analyzed to permit a rational mathematical solution for specific problems.

The propeller agitator has the outstanding advantage that it can be used effectively in tanks of any size or shape. These agitators are frequently made as nozzle-mounted vertical units. They should always be placed at an angle, in order to effect proper circulation in the vessel whether the vessel be vertical or horizontal. In horizontal vessels usually more than one unit is applied. Since the vertical propeller agitator is limited with respect to the length of its unsupported shaft, it cannot be used effectively in a very large tank. In this case the so-called side-entering propeller agitator can be used to good advantage and in many cases, depending on the size of the tank, several units are installed. Single units are seldom built in excess of 25 to 30 hp.

In order to determine the power required by a three-bladed propeller, the following equation may be used:

$$Hp. = 0.00176\ V^3\ A\ F_\mu\ S \qquad (3)^*$$

where Hp = horsepower consumed; V = pitch velocity, fps. = $(PN)/60$; when this velocity is lower than 7 fps., use Fig. 3 for correction; F_μ = viscosity factor (see Fig. 1); A = area, sq. ft. = πR^2; S = specific gravity; N = number of revolutions per minute; P = propeller pitch, ft.; and R = propeller radius, ft.

A further improvement in mixing operations can be accomplished only by the use of an agitating device that is capable of effecting a larger degree of mixing *per se*. Homogenizers accomplish this. They intimately mix the materials as they pass through, but in turn are not effective as agitators. The recently developed agitator known as the Velofin (for which patents are pending) is believed to be the only industrial agitator which both mixes materials as they pass through and still is effective as an agitator.

With paddles, turbines and propellers the movement of liquid is effected by a direct pushing action and the surface friction between the agitator and the liquid reduces the efficiency. However, surface friction is the only means by which the disk agitator transmits motion to the surrounding liquid, so all of the friction produced appears as useful work.

The Disk Agitator

This type of agitator consists of two or more round, flat disks closely spaced on a central shaft. Suitable liquid inlet orifices in the disks are placed around the shaft. During rotation the liquid layers in the spaces between the disks are set in motion by the friction between disks and liquid, causing the liquid to flow outward in a helical path and discharge at high velocity, and nearly tangentially, at the disk periphery. Since the discharge velocity varies with the disk diameter, spacing and velocity of rotation, as well as with the liquid properties, any degree of agitation from mild to violent can be secured.

The circulation pattern for the disk agitator in vertical cylindrical vessels is similar to that of the turbine in a similar position, but the disk type is more versatile in that it can be applied effectively in either horizontal or vertical vessels, or on a vertical, angular or horizontal shaft. When used as a side entering agitator no baffling is needed. Another element of versatility arises from the fact that the disk type can be proportioned for any desired type of performance with any kind of liquid, and its performance can easily be altered in the field, within the limits of the motor power, simply by changing the spacing, number or diameter of the disks secured to the shaft. Since the agitator is inherently balanced and operates at full motor speed, it tends to minimize stuffing box and bearing problems, at the same time simplifying motor selection.

TONNAGE OXYGEN

(*Continued from page 117*)

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balance promises to continue. Methods are needed to make it other than by the electrolysis of salt. Some of these are in use. Others are being tested.

The production of hydrochloric acid as a byproduct of chlorinating hydrocarbons is growing rapidly and has been estimated by R. B. MacMullin already to amount to almost 400,000 tons, 100 percent basis, per year. Production of this byproduct is scattered and if reconversion to chlorine were to employ oxygen, the installations would have to be large to be economic. A rough guess is that an oxygen plant would not pay off to operate solely on less than 100 tons of hydrochloric acid per day although special conditions might reduce this figure.

U. S. patent 2,206,399 describes a two-step method for recovering chlorine from hydrochloric acid by passing gaseous HCl into contact with, for example, iron oxide, cadmium chloride and potassium chloride until the iron oxide is converted to iron chloride, after which oxygen is used to liberate chlorine from the iron chloride and regenerate the iron oxide. Assuming that the process is feasible, it still is limited economically to locations where large quantities of hydrochloric acid are available. However, instead of using hydrochloric acid as a raw material the patent claims that ammonium chloride may be converted to ammonia and chlorine. If such a process could be put into practice, the impact of tonnage oxygen on the soda ash and chlorine industries would surely be as important as any other application of oxygen so far visualized.

EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

Platform Plank No. 1

IN THE NEXT few months we shall have many opportunities to gage the potential impact on our national economy of various local and national proposals put forward by political candidates. It behooves us as engineers, as well as citizens, to do all we can in our communities "to make economy in government politically popular."

During recent depression and war years the piling up of a debt load on the national economy was unavoidable. Beginning today, however, it should be our major concern to see what we can do to reduce that burden of debt. As the summer heat turns to political heat this fall, we urge that whenever possible you resolve the issues in favor of sound economy in the nation's business.

Saluting Our Northern Neighbor

CANADA and the United States have worked closely together for many years. This relationship was strengthened by the war. Now the common fear of trouble with Russia assures continued and even greater cooperation between these two good neighbors.

This cooperation is well exemplified by the chemical industries. Participation of U. S. firms in the Canadian chemical industry is striking, as 68 percent of the total investment is controlled in the United States. Canada depends upon the parent firms for research and development. She looks to America to supply complex dyestuffs and many organic chemicals which need large and varied markets before manufacture can be reasonably undertaken.

On the other hand the U. S. chemical industry regards Canada as a logical field in which to expand its manufacturing activities and as a market for many of its products. We look to our northern neighbor for her natural resources and basic raw materials, and we gladly employ the engineers and chemists from her universities who are attracted here by larger salaries and greater opportunities.

It was the increasing importance of this friendship and the recent expansion of the Canadian chemical industry that prompted the *Chem & Met* Report on that country's industry which appears elsewhere in this issue.

For More Realistic Appropriations

SELDOM does Congress so sharply criticize a government agency as did recently a House of Representatives subcommittee on appropriations. That body, after reviewing the requests from the so-called "Independent Offices" recommended curtailment of certain funds for next year for several agencies, including the Atomic Energy Commission. The following paragraph of the committee report deserves thoughtful consideration:

"As a matter of fact, there is some feeling among the membership of the committee that the Commission has taken advantage of its strategic position in modern military defense to avoid facing the practical realities on less important and subsidiary elements of their budget. The impression left with the committee is one of general extravagance."

This seems again to foreshadow another controversy between executive and legislative leaders. Some difference of opinion is expected. But so radical a difference as has developed regarding funds for AEC is most unfortunate. No one questions the importance of the job of atomic energy development. No one begrudges funds for sound undertakings, even though of somewhat doubtful end result. Parsimony is out of place. But extravagance is equally unjustified.

We do not think that the legislators are inspired in this matter by any partisan purpose. We believe that it is time for the commission and its senior technical personnel to be most realistic in planning. A program discredited by unwarranted cloak of secrecy is just as much against the public interest as a program would be if neglecting important possibilities for engineering research and development, no matter how uncertain the end result may initially seem.

Chemical engineers and executives have important influence in this field. It should be exerted in the direction of constructive realism.

Plans for Reserve Officers

MANAGEMENT in every process industry will shortly face two classes of problems in connection with military personnel. One will be the draft of young men, or their enlistment. The other will affect plans of older technical employees who are reserve officers. These are quite distinct problems, but both deserve serious and early review.

Technical men having reserve commissions in any of the military services are now given an opportunity to join in special technical training groups. If there are a dozen or twenty such persons in any locality, they can get together and form cooperative groups for mutual aid in military advancement. With the lead of the Army, these plans are being formulated to include men and women of the Army, Navy, and Air Force. Members of local groups will not all work on a single problem. But as a group they will be able to secure reserve assignments for which they are duly prepared and can make substantial contributions.

Details for these programs are not fully worked out.

They have, however, advanced far enough for interested management and technical personnel to initiate local programs appropriate for the reserve officers in their communities. Three benefits may be expected: The military will get better acquainted with those reserve officers having technical skills. The reserve officers may advance themselves in reserve rank as their proficiency is demonstrated. And these technical men will be given assignments where their technical skill would be utilized in the event of an emergency.

Individual officers may secure information through their normal military channels. Or a group of twenty or more may address their inquiry to the technical corps r to the research and development group of the Army General Staff. It seems likely that management encouragement of such action by groups of reserve officers may be just the needed push to get worthwhile programs under way.

For Improved Controls

ANNOUNCEMENT by the Atomic Energy Commission of the availability of several "tagged" chemicals, in the production of which a radioactive isotope has been used, foreshadows improved engineering control in many processes. While the radioactive elements themselves have been available for the past two years, it has usually been necessary to introduce them into various compounds in small lots at considerable expense and inconvenience.

Among the selected compounds which will first be produced under this program by the AEC are methyl alcohol, ethyl alcohol, acetylene, acetic acid and a considerable number of other chemicals in which carbon-14 has been used in their synthesis. It is hoped by the Commission that private firms will be interested in producing these compounds for general distribution, obtaining the radioisotopes from the Oak Ridge National Laboratory. In our opinion, it will not be long before the Commission's hopes are realized.

Among the more favorable aspects of this program announced last month is the expectation that inventions or discoveries following the use of these isotope-labelled compounds "will be subject to patenting by the inventor in accordance with normal industrial practices." Publication of the significant results of investigations using radioactive materials will be required by AEC, but these requirements "will be applied so as not to interfere with an inventor's opportunity to obtain patent protection for his inventions and discoveries."

Bungles in Planning

PREPAREDNESS plans for chemicals are being drafted in Washington by many agencies. Some of these programs are distressingly unrealistic. Two faults deserve notice here for they are correctable if all concerned will simply take each opportunity to put the government planners back on the track when we find they have gone astray. One has to do with the basic data being used. The other arises from inexperience and lack of acquaintance with the complexity of chemical manufacturing.

In a number of cases the data furnished by the Census Bureau in its monthly and quarterly summaries are lacking important information. Far too often new manufacturing operations begin and continue unnoticed by the government statisticians for considerable periods. As a natural consequence the war planners, assuming the data reliable, may project erroneous programs.

Correction should obviously come through prompt revision of basic data at the Census Bureau. When new developments occur, these should be brought promptly to the attention of the statistical groups so that the basic figures issued may at all times be maintained as close to the truth as possible. We are only fooling ourselves when we think it smart to withhold figures until the government accidently catches up with the fact that there are new producers or new sources of data.

Unfortunately the government has lost most of its experienced chemical procurement officers, either through retirement or to more lucrative employment in industry. The new men, full of zeal, lack broad acquaintance. Again it is the responsibility of industry to guide these newcomers into sound and safe plans. They must be patiently educated as to the complexity of chemical enterprise. They must be shown that abrupt buying of one commodity often upsets other industry units or other commodities equally important in preparedness planning.

It may be well if each of us accepts some measure of personal responsibility in seeing that the governmental agencies are given every opportunity to improve their data and to enlarge their acquaintance with all phases of the problems involved in chemical buying. Only through such cooperation can we expect to avoid costly and possibly dangerous shifts in government procurement.

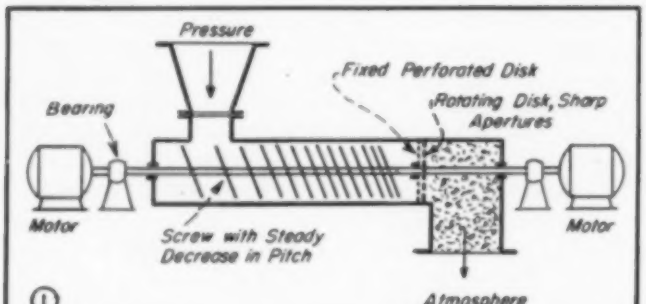
Flowers for the Living

HUXLEY, the elder, once said in effect that medals and similar honors should not add to the ego of old men, but rather should challenge and inspire the younger generation. We agree that great good is often done by awards to young men early in their professional careers. But on a number of occasions we have found great satisfaction in seeing that recognition is given to distinguished seniors nearing the end of their most productive periods—men who could look backward as well as forward in our profession.

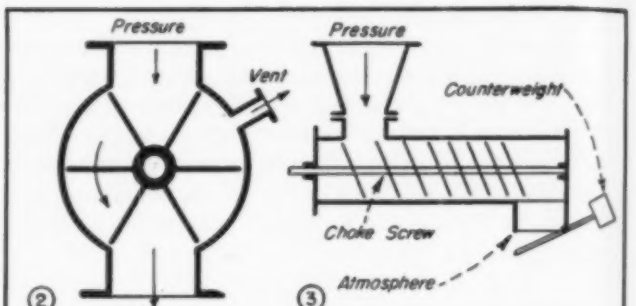
These thoughts come to mind this month with the sad news of the death at 68 of a great teacher and researcher, Dr. Clarence W. Balke of the Fansteel company. Here was a man who had contributed mightily to the world's store of knowledge in the chemistry and metallurgy of tantalum, columbium, tungsten, and the rare-earth metals. A quiet, modest worker in his secluded laboratory rather than in the limelight of publicity, Dr. Balke received all too little credit for discoveries that have meant so much to mankind during the past few years. Yet by happy circumstances he was selected to receive this year's award of the Perkin medal—the highest individual honor of the chemical profession in America. Those of us who were his students know that that well-deserved recognition was no sop to the ego of an old man. Rather it was the sort of tribute we all want to pay our leaders in the profession. Yet all too often we wait until they die to tell the world about their achievements.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR



Shredder-seal combines good points of two older devices . . .



. . . the rotary seal and the ordinary choke-screw conveyor.

New Way to Pressure-Seal Solids Flowing Through a Continuous Process

J. F. SCHNACKY
Chemical Engineer, Fischer & Porter Co.
Hatboro, Pa.

June Contest Prize Winner

THERE IS evidence at present of a trend toward continuous flow processes involving the continuous introduction and removal of solids, to and from vessels operating under considerable pressures. For example, processors of oil bearing seeds and beans, from which animal feeds are made after extraction of the oil, have in recent years found that the vitamin efficiency and protein availability of the resultant feed depends upon both the time and the temperature of the toasting operation. A shorter time at a higher temperature is found in some cases to produce a very superior feed for blending purposes.

In another direction, interest is increasing in a variety of solids processing operations employing fluidized solids which again must be treated in continuous flow. Some of these processes, most of which at present are still in the "talk" stage, will doubtless operate at high pressures. Among them, most probably, will be found pressure processes for the complete gasification of coal, such for example as the German Winkler process. Although it is possible to feed such processes semi-continuously by the alternate charging and discharging of two or more pressure feed vessels, a reliable continuous method would have obvious advantages.

Heretofore the efforts at continuous feed across considerable pressure differentials have followed the method of the rotary valve (Fig. 2), or the choke conveyor (Fig. 3) which makes use of a flapper at the end of a screw conveyor of continuously decreasing pitch. The first method, while it may prove effective during initial operation, has so far always meant high maintenance cost and only a moderate pressure seal. The choke conveyor is a more practical approach to the problem but as Fig. 3 indicates, it cannot be expected to operate under high pressure differentials owing to gas leakage, while with many materials a tendency to pack may preclude the possibility of intermittent operation.

Although it is not expected to be a panacea for all solids feeding and discharging processes, the shredder-seal suggested in Fig. 1 is advanced as a combination of rotary valve and choke conveyor which in many sorts of operation can be counted on to overcome the disadvantages of both its parents with the only disadvantage of comparatively high power comsumption.

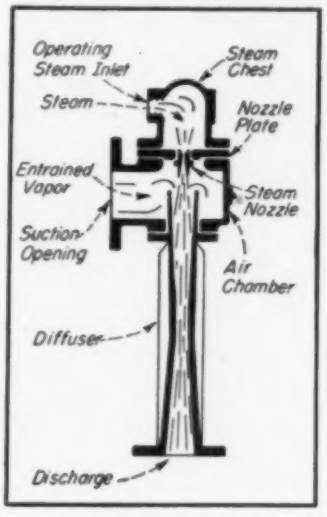
The shredder-seal, as the sketch shows, employs a screw with a steadily decreasing flight pitch, so as to form a solids plug at the discharge end. Further rotation compresses the plug and forces it through a fixed perforated disk. On the far side of this disk, and rotating in a counter direction, is a rotating disk with knife-edge apertures which disintegrates the solids for further handling. Should a higher pressure be desired, it is only necessary to change to disks with finer apertures to enable the plant engineer to affect the proper pressure seal with the least power consumption.

It must be recognized, of course, that any high pressure seal will consume more power than the usual lower pressure seals. However, the shredder-seal offers the advantages of maintaining higher process pressures, of being adjustable, and of disintegrating solids lumps for subsequent even reaction. By permitting higher pressures it will in certain reactions enable shorter reaction times to be employed, thus increasing output and reducing equipment investment for a given capacity. In addition to its rugged construction, which means reduced maintenance, in many cases it should result in an upgraded product.

Aside from its use on relatively non-abrasive materials, the shredder-seal has not yet been used sufficiently to indicate what limitations it may have with respect to the properties of the materials handled. However, considering the possibilities of employing abrasion resisting metals and hard facings, it seems likely that it would prove successful in a wide variety of cases.

Keeping up the Performance of Steam Jet Ejectors

IN A RECENT ISSUE of *Power Fax*, published by the Elliott Co., L. S. Stinson of the company's heat transfer department detailed the methods of finding whether an ejector or its vacuum system was at fault in case of bad performance, and what to do about it if the trouble lay with the ejector. An abstract of the main points is given here.



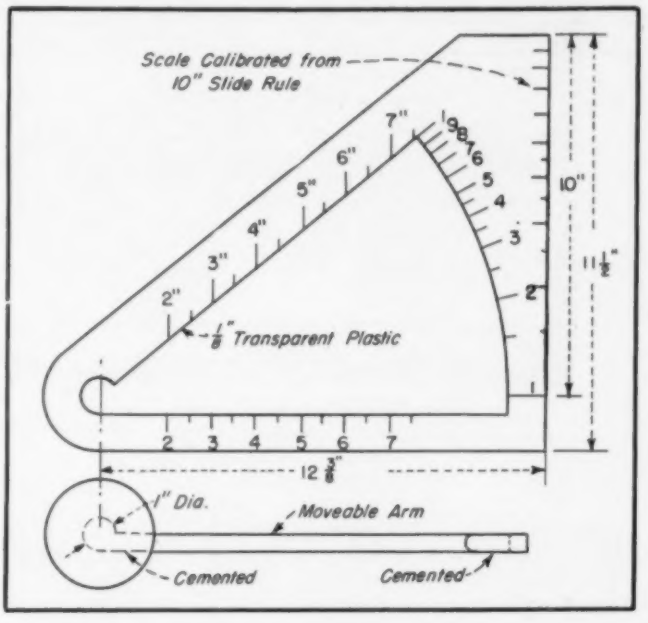
When a steam jet ejector begins to produce unsatisfactory vacuum after some months or years of satisfactory work, the problem is to find out why, and then to make the needed repairs. The first thing to check is the possibility of a gradual change in operating conditions. The steam pressure should be measured with a test gage (not the gage regularly on the unit), while the temperature of the condensing water for the intercondensers, as well as the temperature rise across the intercondensers, should be measured to make certain that design conditions are being met. If all design conditions are being met, then the ejector should be isolated from the system by means of a valve or blank flange to find whether ejector or system is at fault.

If the isolated ejector pulls a better vacuum than it formerly maintained on the system and holds steady, the trouble is with the system which must then be checked for leaks. If the no-load vacuum is higher but unsteady, it may be that the ejector is still not at fault since it may not have been designed for stability at shut-off. If this is the case it should be steady with approximately 10 percent higher than design steam pressure, or when it is handling about 20 percent of its rated load of gas (all gases with single-stage ejectors, non-condensibles only with multi-stage). A test can be made by drilling the blank flange, the hole area in square inches equalling the rated hourly air load divided by 895.

If the tests indicate ejector trouble, the ejector should be dismantled and cleaned of foreign deposits and scale. Nozzles and diffusers particularly should be checked for wear and corrosion against the original drawings. With multi-stage ejectors, work forward from the last ejector. Make sure especially that there is no steam leak through the nozzle threads. Then looking through against a light, examine both ends of both nozzle and diffuser for scale, pits, grooves and rough spots. Scrape out scale carefully, and polish rough spots with fine emery cloth. Check throat diameters of both nozzle and diffuser for both enlargement and out-of-round. Check and clean the intercondensers of possible deposits of congealed materials.

A badly chewed nozzle or a deeply scored diffuser should be discarded and replaced since repair will usually be more expensive. If nozzle or diffuser throat diameter, or both, have increased determine the percentage increase in area compared with the original plans. More nozzle percentage increase can be tolerated than diffuser wear. If the nozzle increase is greater or equal to that of the diffuser, and not over 7½ percent, probably satisfactory operation can be expected. If between 7½ and 15 percent, the vacuum will probably be poorer than before, and may fluctuate a little. More than a 15 percent increase probably calls for a new nozzle and diffuser. If, however, the percentage increase for the diffuser throat is greater than that of the nozzle, the ejector will not work well until the nozzle has been re-drilled and finished to have a percent area increase equal to or slightly greater than that of the diffuser. Worn diffusers cost more to repair than to replace. A new diffuser will operate with a worn nozzle, but the reverse is not true.

If slightly higher steam pressure will keep an old ejector in stable operation, the percentage increase in absolute steam pressure needed is an indication in most cases of the percentage the nozzle area should be increased to keep the ejector working properly on the rated or slightly higher steam pressure.



Tool for Designing Logarithmic Scales And Nomographic Charts

GLENN A. PETTIT
Michigan Chemical Corp.,
St. Louis, Mich.

RECENTLY I constructed an extremely useful tool for the calculation and design of logarithmic scales such as those used in nomographs. Although it is usually possible to use log paper or slide rule scales in the calibration of log scales of 2½, 5 or 10 in. length, invariably one or two

July Prize Winner

A $50 prize will be issued to

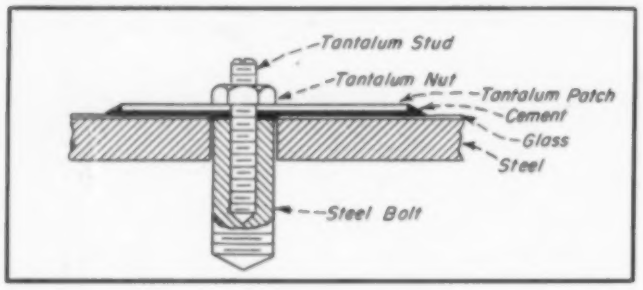
Roy W. Barns
Chemical Engineer, Detroit, Mich.

For an article describing a new proportioning device for liquids, suited to either batch or continuous processes. It can be made of corrosion resisting materials and operates without attention. The article has been judged the winner of our July Plant Notebook contest.
This winner will appear in September. Watch for it!

of the scales needed are odd lengths. The proportional divider shown above, plus a pencil, is all that is needed in constructing straight line nomographs with scales of any length within the scope of the instrument.

When designing charts of multi-variable type and the lateral length and location of the scales have been calculated, it is a simple matter to place the tool upon a vertical line, move it horizontally to the correct length and, by adjusting the movable arm, quickly divide the scale.

Although the dimensions are quite flexible, those shown on the sketch have been very satisfactory. The tool is made from ¼ in. transparent plastic such as Plexiglas or Lucite and is cut out with a jig saw. The movable arm must be perfectly straight and the bearing should be a smooth fit. The calibrating marks are scratched in with a sharp tool and filled in with red pigment.



Emergency Patch Operates Successfully On Glass Lined Vessel

STANLEY YOKELL
Chemical Engineer, Union, N. J.

DURING the batch distillation of chloral from chlorinated alcohol which had been treated with sulphuric acid, bottoms material began spouting up through the hollow agitator shaft, indicating that a hole existed in the lower portion of the agitator. As an emergency measure, oversized rubber stoppers were forced down into the shaft and the distillation continued until complete. The residue was dumped, and the kettle opened and washed with a neutralizing wash, as was the inside of the agitator shaft, from which the stoppers had been removed with a packing puller.

Because of the time required for the manufacturer's expert to come to the plant, it was decided to install a homemade patch (*above*) by the following method:

After thoroughly drying all the parts, the hole was carefully drilled out and threaded to receive a ⅜ in. NF steel bolt, using only a starting tap to thread the hole. The bolt was cut so that when it was completely socked home, it would be countersunk ⅛ in. below the surface of the agitator. The top of the cut bolt was slotted to receive a screwdriver blade. A ⅛ in. hole was then drilled three-fourths of the depth of the steel bolt, and tapped, again using only a starting tap, to receive a ⅛ in. NF bolt. Using only the starting tap makes a very tight fit. A tantalum stud bolt, slotted for a screwdriver was then screwed into the countersunk steel bolt. Glass bonding cement was mixed and filled into the countersunk portion and spread on the surrounding surface for approximately 1 in. diameter. It is necessary that the vessel in which the cement is mixed, and the parts to which it is applied, be spotlessly clean and dry. A thin piece of tantalum was cut out to form a patch 1 in. in diameter and drilled at its center to fit over the tantalum stud. It was then slipped down over the stud and pressed tightly on to the surrounding surface. A tantalum nut was then run down on to the stud.

To dry the cement a 100-watt light bulb was hung 1 in. above the patch for 24 hours to insure slow drying, since the cement expands and contracts on drying.

To test the patch a length of pipe was gently inserted into the shaft through a cored out rubber stopper, supported and filled with water. After several hours under the 20 ft. head of water no leaks were apparent and the kettle is now in successful operation.

Radioactive Tracers for Determining Field Concentrations of DDT

A NOVEL USE has been made of the new knowledge of radioactive materials which resulted from research during the war. By employing minute amounts of a radioactive material, research workers of the Chemical Corps have developed a method for the evaluation of insecticide dispersal in the field. It is now possible to detect 0.001 lb. of DDT per acre of ground and there are indications that, with refinements in the method, even smaller amounts of this insecticide can be determined.

Radioactive manganese is dissolved in the DDT mixture and the latter is dispersed over the ground by spraying or other means. A Geiger counter is used to evaluate the distribution of the radioactive substance.

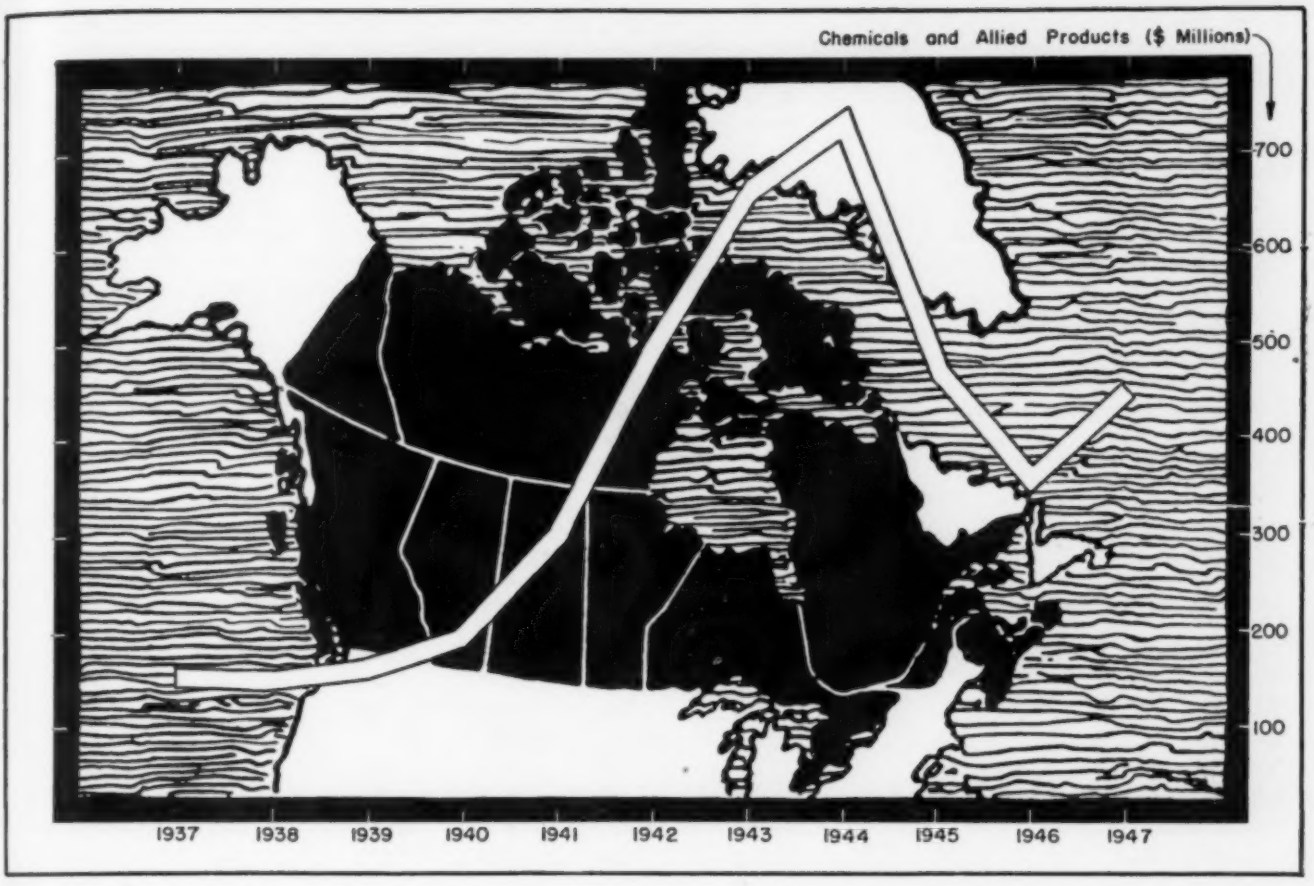
Other tracer methods involving the use of dyes, fluorescent materials and metallic particles were investigated and the use of dyes showed promising results. But the radioactive tracer method proved to be the best for extremely small concentrations of insecticide.

The work was done by J. H. Ladd, P. T. Mosley, J. G. Hartnett, J. Goldenson, C. W. Huffman, and C. R. Naeser of the Analytical Branch, Chemical Division, Chemical Corps Technical Command, Army Chemical Center, Maryland.

$50 Cash Prize For a Good Idea!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the August winner will be announced in September and his article published in October. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.



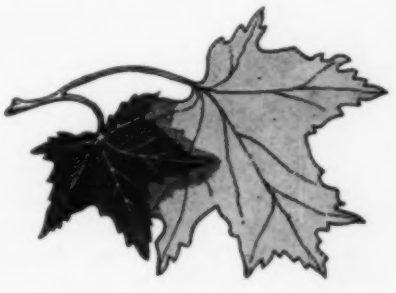
Canada's Chemical Progress

In the land of maple leaves much of the great wartime expansion of the chemical industry is already absorbed in peacetime operations.



CANADA is the largest country in the western hemisphere. Certain areas, such as the St. Lawrence Valley, parts of the Maritimes, the prairies and the coastal plains of the Pacific are fertile and situated in latitudes that invite vigorous population growth. That the growth has been clear-cut is proved by the census. In the decade from 1930 to 1940 there was an increase in population of over 11.5 percent, and since that time the rate of increase has been even greater. The estimated population in 1947 was twelve and a half millions.

With the opening to settlement of the west after the Canadian Pacific Transcontinental Railway was put through in 1885, there was an important shift in population from east to west. However, this has been reversed in the latest decade, and even to some extent in the previous one, when the trend of growth has been on the whole back from west to east, though the percentage increase in British Columbia in these two decades was higher than in any other province. In recent years the large growths have been in the industrial provinces of Ontario, Quebec and British Columbia, in that order.



The trend toward urban life in Canada is very striking. Early in the second half of the nineteenth century signs of an increase in the small urban population were beginning to be seen, and with the expansion of manufacturing industries and the increasing ease of transportation and communication, that proportion grew continuously. The great advance of employment during the war years in the larger cities of Canada is evidence of the drain from country to city that has taken place since the 1941 census.

War revolutionized the industrial life of the Dominion and the tre-

Chemical Process Industries in Canada, 1946

Industry	No. of Plants	No. of Employees	Salaries and Wages	Fuel and Electricity	Cost of Materials	Gross Selling Value
			(Thousands of Dollars)			
Chemicals and allied products						
Coal tar distillation	10	386	716	310	2,960	5,193
Heavy chemicals	27	4,983	10,053	5,608	12,932	44,560
Compressed gases	42	1,107	2,026	375	1,275	8,628
Fertilizers	28	3,200	7,320	4,038	23,745	50,642
Medicinals and pharmaceuticals	213	8,050	13,114	423	23,467	64,186
Paints and varnishes	95	5,125	9,657	470	27,096	53,381
Soaps and washing compounds	145	2,389	6,488	665	18,611	37,445
Toilet preparations	94	2,064	2,818	52	7,088	18,920
Inks	30	583	1,391	48	2,399	5,562
Hardwood distillation	5	243	375	196	837	1,433
Adhesives	21	623	1,142	190	3,395	6,284
Polishes and dressings	54	755	1,079	38	4,896	9,035
Miscellaneous*	204	6,769	16,266	1,103	19,887	50,701
Total, chemicals and allied	968	36,277	72,445	13,516	148,588	355,970
Pulp and paper	104	37,896	78,533	37,359	157,995	369,846
Distilled liquors	17	3,180	5,377	1,393	20,533	46,719
Wineries	30	682	1,058	79	3,075	6,354
Breweries	61	7,125	14,188	1,351	18,021	82,492
Vegetable oils	11	462	729	135	10,641	13,188
Malt and its products	11	459	945	518	8,472	12,900
Rubber goods	56	21,421	35,979	4,510	82,188	169,511
Dyeing of textiles	40	1,667	2,516	517	1,266	6,951
Starch and glucose	8	1,009	1,636	517	8,879	11,790
Sugar refining	11	2,590	4,576	1,476	48,033	63,875
Leather tanning	75	4,472	7,585	828	28,234	45,011
Glass	5	3,321	5,416	1,655	6,107	17,988
Artificial abrasives	6	2,251	4,419	2,496	8,210	25,536
Coke and gas	34	4,747	8,941	6,479	37,809	69,576
Petroleum refining	32	6,699	14,121	8,997	152,687	209,125
Non-ferrous smelting and refining	16	3,371	44,537	36,908	313,996	474,207
	1,485	137,629	303,001	118,734	1,048,627	1,981,039

* Includes explosives, plastics, insecticides, matches, etc.

mendous manufacturing expansion has turned Canada into a predominantly industrial nation. It has provided a foundation for stability and progress. With a wealth of raw materials to supply her factories, and abundant supplies of electric power at her disposal, this is only natural.

A new investment program of $2,800,000,000 representing capital expenditures by business enterprise, institutions and government, as well as outlay on housing, is anticipated for 1948. This outlay, if realized, would involve an increase of about 17 percent over that spent in 1947. According to type of expenditure, the new investment program falls into two parts. New construction outlay estimated at $1,600,000,000 is up 21 percent over the previous year. The purchase of new equipment involving an outlay of $1,200,000,000 is up 12 percent. Canada is experiencing an unparalleled investment boom.

The manufacturing industries of Canada are concentrated largely in the provinces of Ontario and Quebec. Ontario is the dominant manufacturing province. In 1946 with only 37 percent of the total number of establishments reporting, plants in Ontario furnished employment to 47 percent of the number of persons engaged in manufacturing and produced over 46 percent of the entire output. Quebec ranks second with 31 percent of the output, while British Columbia with 8 percent of the output ranks third.

In 1946 Canada's manufacturing industries were led by pulp and paper with meat packing and slaughtering in second place, and non-ferrous smelting and refining in third position. Petroleum products was eighth in importance, and rubber goods was twelfth, followed by the other process industries.

Today, chemicals and allied products stand as one of the nation's leading activities. The value of these materials in 1947 amounted to $400,000,000, 10 percent more than in the preceding year, or 2½ times the 1939 total. All phases of the industry experienced growth, and the new products and processes and technical improvements appeared in answer to problems created by war. During the two-year period, 1946-47, the volume of building amounted to $46,000,000. This was more than half of the value after depreciation of the total pre-war production facilities of the industry. The greatest expansion was of heavy chemicals, particularly sul-

phuric and nitric acid which enjoyed a major expansion. Among other industry increases, that of compressed gases was outstanding.

Canada has a strong and diversified heavy chemical industry which now supplies about 70 percent of the Dominion's chemical needs and, in addition, makes a substantial contribution to export trade. It has buildings and equipment valued at 120 million dollars, employs 10,000 workers and annually distributes 18 million dollars in salaries and wages and 40 million dollars for materials, fuel and power. Its production expanded during the war to reach a total value in 1945 of 110 million dollars and much of this new capacity has already been absorbed in peacetime operations.

The dominance of United States firms in the Canadian chemical industry is striking, as 68 percent of the total investment is controlled in the U. S. The largest firm in the Canadian field is Canadian Industries Ltd. which is jointly controlled by E. I. du Pont de Nemours & Co. and Imperial Chemical Industries in the United States and the United Kingdom, respectively. Among the other large manufacturers of chemicals is the Canadian firm, Shawinigan Chemicals Ltd.

The chemical industry was early concentrated in the eastern provinces, attracted by the proximity of hydroelectric power, especially at Niagara Falls and Shawinigan Falls, by the availability of raw materials, and by the presence of such factors as manpower, harbor facilities and transportation. This concentration of the industry continued during the war period but to a lesser degree. The more recent industrial settlement in British Columbia has accounted for a noticeable number of new establishments.

"Looking to the future," recently stated George W. Huggett, president of Canadian Industries Ltd., "we recognize that, as a result of Canada's wartime experience, we have reached a point of departure for further progress. Already various companies have developments under way that may be expected not only to widen the scope of the chemical industry, but also to open up in this country possibilities of future expansion of many associated industries. For some time, however, there will be a large number of chemicals which cannot economically be produced in Canada. There are, for example, some of the more complex dyestuffs and groups of related organic chemicals as well as many inorganics which need large and varied markets before manufacture can be reasonably undertaken. Moreover in some instances the location of raw materials in relationship to markets represents a considerable handicap. Because of these factors, Canada will continue to be dependent on the importation of a number of her chemical requirements for some time to come."

SULPHURIC ACID—Canadian Production, Imports, Exports

Year	Production	Imports (Tons, 66 deg. Be Basis)	Exports
1936	241,075	108	1,128
1937	282,716	108	1,608
1938	268,339	95	1,260
1939	249,558	119	1,605
1940	323,542	142	2,224
1941	482,533	3,671	3,315
1942	592,597	665	13,692
1943	641,127	221	31,414
1944	722,141	190	18,960
1945	713,000	149	11,203
1946	637,094	166	3,296
1947	717,830	116	29,909

SULPHURIC ACID—Canadian Producers and Their Capacities in 1947

Company	Plant Location	Capacity of 100%	Process
Aluminum Co. of Canada Ltd.	Arvida, Que.	30,000	Contact
Canadian Industries Ltd	Copper Cliff, Ont.	50,000	Contact
	Hamilton, Ont.	25,000	Contact
		30,000	Chamber
Consol. Mining & Smelt. Co. of Canada Ltd	Trail, B. C.	400,000	Contact
Dominion Steel & Coal Co. Ltd.	Sydney, N. S.	12,000	Chamber
Nichols Chemical Co. Ltd	Valleyfield, Que.	50,000	Contact
	Sulphide, Ont.	35,000	Contact
	Barnet, B. C.	10,000	Contact
N. Amer. Cyanamid Ltd	Welland, Ont.	120,000	Contact
Total		762,000	



Sulphuric Acid

Typical of the swiftly growing chemical industry in Canada is sulphuric acid production. The 250,000-ton (66 deg. Be. basis) production of 1939 was almost tripled by 1944, reaching 722,000 tons that year. The 1947 production was 717,830. This would be a tremendous rate of expansion in any country. The output made Canada independent of others and gave her some little left over for export. Her 1947 exports were 30,000 tons and they are expected to be about 50,000 this year, most of this acid going to the Buffalo area.

In 1947 nine plants owned by Aluminum Co. of Canada, Ltd., Canadian Industries Ltd., Consolidated Mining and Smelting Co. of Canada, Ltd., Dominion Steel & Coal Co. Ltd., and the Nichols Chemical Co., Ltd., and North American Cyanamid Ltd. were in operation. Purchase of the wartime Valleyfield sulphuric acid plant from the government by the Nichols Chemical Co. assures the postwar operation of this plant.

To take care of the even larger requirements for sulphuric acid that were in sight yet more plants were planned. One of these was announced during the year by C.I.L. when it stated a contact plant was under construction at Hamilton, adjoining the old chamber unit at that point.

One of the most striking of the advances from the standpoint of technology has been the development of the cyclic process of acid manufacture. Early in the war Consolidated Mining and Smelting found it necessary to double acid output without building a new plant. This was accomplished in part by redesigning an old contact unit so that it could handle strong sulphur dioxide recovered from fumes by means of an am-

monia absorption system (see *Chem. Eng.* p. 96-99, April 1948). Necessary changes were made in the two catalyst converters. Thus the capacity of the obsolete 35 tons per day unit was soon approaching 200 tons of 100 percent acid. This acid plant at Trail, B. C., is now the largest in the country.

Another Canadian contribution to acid technology has been the use by Nichols of flash roasting flotation tailings from the Noranda mines as a source of SO_2. Three of Canada's acid plants use pyrites, two operate entirely on smelter fumes, and four use imported brimstone.

The fertilizer industry is by far the most important outlet for sulphuric acid. It consumes well over half of the acid produced. Explosives, nonferrous smelters and refineries, and heavy chemicals follow but they are far behind the leader.



Farm Chemicals

Canada, one of the world's leading producers of nitrogeneous fertilizers uses only 10 percent of its total production for its own consumption. As a result she is exporting nitrogen to over 50 countries.

Sales of fertilizers in Canada during the year ending June 30, 1947 were 28 percent greater than in the previous year. That year there were 23 concerns making mixed fertilizers; three superphosphate plants; and three plants making synthetic ammonia fertilizers. In 1947, the output of the industry was valued at 64 million dollars. This compares with 7 million, eleven years ago. Much of this tremendous growth in the industry is due to high prices for agricultural products which have stimulated increased production from the soil in recent years.

Producers of ammonium nitrate are the former Welland Chemicals Ltd., a government war plant recently bought by North American Cyanamid Co., the former Alberta Nitrogen Products Ltd. at Calgary bought by Consolidated Mining and Smelting, Alta. and Consolidated Mining & Smelting Co. Ltd. at Trail, B. C. Superphosphate is made by Canadian Industries Ltd., at McMasterville, Que., Hamilton, Ont., and New Westminister, B. C., synthetic ammonium sulphate is also made by Consolidated Mining and Smelting, at Trail and it is also recovered by several byproduct coke plants. Ammonium phosphate is made at Trail, while cyanamide is made, chiefly for export, by North American Cyanamid at Niagara Falls, Ont.

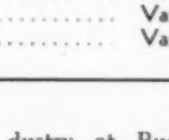
The Alberta Nitrogen Products Ltd., was sold by the government to Consolidated Mining and Smelting in Mid-1946. It is reputed to be the world's lowest cost producer of ammonium nitrate. This plant utilizes the steam-methane process of making hydrogen, developed by Imperial Chemical Industries Ltd. and the pressure ammonia-oxidation process originated by du Pont.

The Welland plant of Cyanamid was originally designed for the production of explosive organic nitrates, the plant has facilities for the production of ammonia by the coke-based process as well as sulphuric acid, and, of course, ammonium nitrate. It is said that Cyanamid is now operating this plant mainly as a nitrate and acid producer.

Canada's first large scale deposits of potash were recently reported from Saskatchewan. They are said to be 100 miles north of Saskatchewan. The report came from the local government which gave it special significance, but it has not yet been proven that the recovery would be economical.. One of Canada's earliest electrochemical plants is located near to the site of the former phosphate rock industry at Buckingham, Que. The Electric Reduction Co. at that point has produced phosphorus and chlorates since early in the century. In recent years they have expanded into a complete range of related phosphorus compounds. They are connected with Oldbury Chemical Co. Niagara Falls, Albright & Wilson of England.

FERTILIZERS—Canadian Producers in 1948

Company	Plant Location
Nova Scotia	
Canadian Industries Ltd	Halifax
Cornwallis Fertilizer Co	Port Williams
Colonial Fertilizer Co. Ltd	Windsor
New Brunswick	
Canada Packers Ltd	East Saint John
International Fertilizers Ltd	East Saint John
Summers Fertilizer Co. Inc	St. Stephen
Quebec	
Agricultural Chemicals Ltd	Chambly
Canada Packers Ltd	Montreal
Canadian Industries Ltd	Montreal
Canadian Industries Ltd	McMasterville
International Fertilizers Ltd	Quebec
Ontario	
Agricultural Chemicals Ltd	Port Hope
Canada Packers Ltd	Toronto
Canadian Industries Ltd	Chatham
Canadian Industries Ltd	Hamilton
Misner Seeds & Fertilizer	Port Dover
Canada Packers Ltd	Welland
Stone, William, Sons Ltd	Ingersoll
United Farmers Co-Operative Co Ltd	Toronto
Witts Fertilizer Works, Ltd	Norwich
British Columbia	
Buckerfield's Ltd	Vancouver
Canadian Industries Ltd	New Westminster
Consol. Mining and Smelting Co. Ltd	Trail
Globe Fertilizer Co. Ltd	Vancouver
Old Gardener Products Ltd	Vancouver



Organic Chemicals

Outstanding progress is being made in the manufacture of organic chemicals. Shawinigan Chemicals Ltd., the most important factor in the industry, is concerned mostly with products based on acetylene. They include acetic acid, butyl acetate, ethyl acetate, acetone, acetylene black, acetic anhydride, acetaldehyde, croton aldehyde, pentasol acetate, vinyl acetate, vinyl resins and butyl alcohol. Recent additions to Shawinigan's list of products include crotonic acid, chloral, and monochloracetic acid.

Shawinigan has recently constructed several new units. The first of these completed was an addition to the acetylene hydration process. Early this year the monochloracetic acid plant

COAL TAR DISTILLATION—Canadian Plants in 1948

Company	Plant Location
Dominion Tar & Chem. Co. Ltd.	Sydney, N. S.
	Ville LaSalle, Que.
	Sault Ste. Marie, Ont.
	Toronto, Ont.
	St. Boniface, Man.
Barrett Co. Ltd.	Montreal, Que.
	Toronto, Ont.
	Winnipeg, Man.
	Vancouver, B. C.
Currie Products Ltd.	Hamilton, Ont.
Northern Tar & Chem. Co. Ltd.	Port Arthur, Ont.

CAUSTIC SODA—Canadian Producers in 1948

Company	Plant Location
Canadian Industries Ltd.	Windsor, Ont.
	Cornwall, Ont.
	Shawinigan Falls, Que.
Aluminum Co. of Canada Ltd.	Arvida, Que.
Dow Chemical Co. (Canada) Ltd.*	Sarnia, Ont.
Dominion Alkali & Chemical Ltd.*	Beauharnois, Que.
Kalamazoo Veg. Parchment	Espanola, Ont.
Howard Smith Paper Mills	Cornwall, Ont.
Can International Paper Mills	Kapuskasing, Que.

* Under construction.

housing a new process was completed. The third is an extension to the vinyl acetate plant and will produce the acetate by the vapor phase process.

The principal producer of coal tar derivatives is Dominion Tar & Chemical which makes cresylic acid, phenol, cresol, ortho cresol, para cresol and naphthalene, phthalic anhydride and dibutyl phthalate. Naugatuck Chemicals Ltd., Elmira, Ont., is making a range of organics, rubber chemicals, pesticides, etc. Recently acetanilide, nitrobenzene D.D.T. and 2-4,D have been added to its products.

Manufacture of butadiene, styrene and synthetic rubber began late in 1943 at Sarnia, Ont. Sarnia, at one time largely a petroleum center, has become one of Canada's major chemical areas. The development of this phase began with the construction of the government's 48 million dollar Polymer Corp. Recently Dow has constructed a 2.5 million dollar ethylene glycol plant at Sarnia. It is based on cracked petroleum. Polymer and chlorine which they now purchase will be made. Dow made styrene during the war for synthetic rubber. Afterwards they continued to produce it for that purpose, but in addition for polystyrene manufacture by themselves and Monsanto.

Monsanto Ltd. has undertaken an expansion program. A modern unit for production of a polystyrene molding powder was built at Ville LaSalle, Que. Production started in late 1946. This was the first Canadian production of this versatile thermoplastic. To serve more efficiently the growing adhesive demands (mainly phenol-formaldehyde) of Western Canadian industry Monsanto Ltd. decided to construct new and modern plant facilities for the adhesives division at Vancouver.

Bakelite Corp. of Canada Ltd. has long held a dominant position in the Canadian market as a producer of phenolic resins. Early this year the company announced the doubling of the output of phenolic resins, molding powder and laminated products. This required a large plant expansion costing several million dollars. When this plant is completed all operations now carried out at Toronto will be transferred to Belleville, Ont.

Canadian Resins and Chemicals, Ltd. producers of vinyl plastics at Shawinigan Falls are increasing their plant capacity by 50 percent by installing larger equipment. The company is also building a plant in which it will make plasticizer. C. I. L. recently commenced production of chloroform at Shawinigan Falls. All this progress in the Canadian organic chemical industry will have its effect on the import situation.



Salt

Salt production is in for an expansion program with several large new plants and enlargement of existing plants. Soon to begin operations in Alberta is the new plant of Alberta Salt Co., Ltd. at Lindberg, 150 miles northeast of Edmonton. Rated plant capacity will be 150 tons daily. All customary grades of salt will be produced and modern packaging and handling equipment is being installed. Formed only recently, Alberta Salt Co. is jointly financed by Anglo-Canadian Oil Co., Ltd., Home Oil and Calgary Edmonton Corp.

Dominion Tar & Chemical Co. Ltd., one of Canada's major producers of salt and organic chemicals, has made an agreement with the government of the Province of Saskatchewan, whereby Dominion Tar will install a salt plant at Unity. Most of the output will be marketed in the western province.

A new salt plant of 54,000 tons a year capacity is one of the first projects in a wide scale industrial expansion program in the maritimes to get into production. The plant is located near Nappan, N. S., and is operated by Maritime Industries, Ltd., a subsidiary of Standard Chemical Co. The fishing industry of the maritimes will be the principal market.

Expansion of the Windsor salt works is being pushed by Canadian Industries Ltd. The Brummer Mond (Canada) Ltd. at Ambustburg, Ont., Canada's only producer of soda ash, is adding substantially to its capacity.



Caustic Soda & Chlorine

The large salt deposits underlying the Windsor-Sarnia area in southwestern Ontario have formed the basis for the alkali industry. Canadian Industries Ltd. until very recently was the only producer (for sale) of chlorine and caustic in the country. Its first electrolytic plant was built at Windsor, Ont., in 1911. Another plant was put at Cornwall in 1934 and a third was located at Shawinigan Falls in 1938 and commenced operating in 1939.

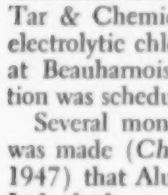
Canada entered the war with an excess chlorine production and was able to export to the United States

until 1943. In that year, however, chlorine imports from the U. S. exceeded exports although an additional plant had been brought into operation in 1942. The increased demand came partly from the use of chlorine in degreasing compounds employed in metal working plants, from the immense demand for hexachlorethane, and from the pulp and paper mills which consume 70 percent of the Canadian output.

In recent years few chemicals have attracted as much attention in Canada as have caustic soda and chlorine and there have been numerous rumors as to the plans of several large companies. The Dominion Alkali & Chemical Co. (subsid. of Dominion Tar & Chemical) has announced an electrolytic chlorine-caustic soda plant at Beauharnois, Que. Initial production was scheduled for 1948.

Several months ago announcement was made (*Chem. Eng.* p. 108, Nov. 1947) that Aluminum Co. of Canada, Ltd. had completed installation at Arvida of a large number of electrolytic cells it had developed with Mathieson Chemical Corp.

These producers will increase Canada's productive capacity to nearly 400 tons per day of chlorine. Dow Chemical of Canada has a new mercury cell unit under construction which will supply their new glycol plant at Sarnia. Kalamazoo Vegetable Parchment has recently completed an installation of Gibbs type of cells at Espanola, Ont., for bleaching sulphate pulp.



Compressed Gases

Wherever compressed gases are used Canada has a plant for their production. The 42 plants making oxygen, acetylene, carbon dioxide and other gases in 1946 were distributed as follows: 18 were located in Ontario, 11 in Quebec, 3 in Manitoba, 3 in Nova Scotia, 3 in British Columbia, 2 in Alberta, 1 in Saskatchewan and 1 in New Brunswick. Since 1939 there has been a 33⅓ percent increase in number of plants and a hundred percent increase in value of products.

New plants have been erected and existing facilities expanded to supply the need for acetylene and oxygen for welding purposes in the ship building, air craft and munitions industries. The greatly increased sale of soft drinks added to the demand for carbon dioxide.

Operations at the new plant of the Alberta Oxygen and Acetylene Co. Ltd. are now underway. The plant will ultimately represent an investment of $500,000.

DISTILLED LIQUORS—Canadian Producers in 1946

Company	Plant Location
Canadian Schenley Ltd.	Valleyfield, Que.
Commercial Alcohols Ltd.	Montreal, Que
Distillers Corp. Ltd.	Ville LaSalle, Que.
Meagher Bros. & Co. Ltd.	Montreal, Que.
Melchers Distillers Ltd.	Berthierville, Que.
Montreal Products Co. Ltd.	Montreal, Que.
Montmorency Distillery, Inc.	Beaupre, Que.
Calvert Distillers (Canada) Ltd.	Amherstberg, Que.
Canadian Industrial Alcohol Co. Ltd.	Corbyville, Ont.
W. & A. Gilbey, Ltd.	New Toronto, Ont.
Gooderham & Worts Ltd.	Toronto, Ont.
L. J. McGuinness & Co.	Mimico, Ont.
Ontario Paper Co. Ltd.	Thorold, Ont.
Joseph E. Seagram & Sons, Ltd.	Waterloo, Ont.
United Distillers, Ltd.	Grimsley, Ont.
Hiram Walker & Sons, Ltd.	Walkerville, Ont.
British Columbia Distillery Co. Ltd.	New Westminster, B. C.
United Distillers Ltd.	Vancouver, B. C.



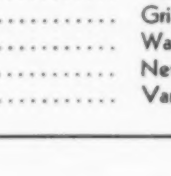
Industrial Alcohol

The ethyl alcohol picture has changed rapidly in Canada in recent years. Production increased from 4,932,189 proof gal. in 1939 to 20,325,529 in 1943, but with the end of the war has come a reduction to 10,123,618 in 1946 (shipment by distillers). In 1939 production of methyl alcohol was 335,093 imperial gal., 100 percent, rising in 1941, the peak year, to 553,339 gal., and falling back to 423,295 gal. in 1943.

The large increase in ethyl alcohol in Canada was accomplished by converting liquor distilleries to industrial alcohol and by expansion. The output was adequate for Canadian requirements and large volumes were shipped to the United States.

With the encouragement of the Canadian Government, the Ontario Paper Co. in 1942 undertook the recovery of alcohol from waste liquors of the sulphite pulp mill. The project, the first of its kind to be successful in the North American continent, was undertaken at the company's own expense. The plant at Thorold, Ont., has a capacity of 800,000 U. S. gal. of 190-proof alcohol. Not only was this development of great importance to the alcohol and chemical industries but also to the pulp and paper industry.

A somewhat similar industrial alcohol plant has been announced. It too will depend upon waste sulphite pulp liquor for raw material. This plant of Commercial Alcohols Co., Ltd., will be adjacent to the Gatineau mill operated by Canadian International Paper Co. It will be on the Quebec side of the Ottawa River, several miles from the city of Ottawa. This mill it has been reported will have a capacity of 1,000,000 imperial gal. of ethyl alcohol a year and will cost in the neighborhood of 25 million dollars.



Petroleum

Petroleum refining is one of the country's largest industries and one that is growing rapidly as the per capita consumption of petroleum products is increasing constantly. At the present time there are 33 refineries with a production of 210 million dollars. The total refinery capacity in 1945 totalled 238,000 bbl. of crude oil per day.

At the present time Imperial Oil, Ltd., one of the most important companies in the industry, is in the midst of the largest construction program in its long history. The program includes large investments in several parts of Canada and in Newfoundland.

One of the new developments that is attracting considerable attention is Canada's first fluid catalytic cracking units at the Montreal East refinery of Imperial Oil Ltd. It has a capacity of 11,000 bbl. per day. This same refinery will also have a new 7,000 bbl. per day catalytic polymerization plant and a new crude pipe still. Imperial's Sarnia refinery production has been in-

AMMONIUM SULPHATE—Canadian Producers in 1948

Company	Plant Location
Algoma Steel Corp. Ltd.	Sault Ste. Marie, Ont.
Consol. Mining & Smelt. Co. of Canada Ltd.	Trail, B. C.
Dominion Steel & Coal Corp. Ltd.	Sydney, N. S.
Hamilton By-Product Coke Ovens, Ltd.	Hamilton, Ont.
Montreal Coke & Mfg. Co.	Ville LaSalle, Que.
Steel Co. of Canada, Ltd.	Hamilton, Ont.

PAINT and VARNISH—Canadian Growth, 1936–1947

Year	No. of Plants	Employees	Value of Products at Works
1936	78	3,124	$22,651,225
1938	87	3,412	24,317,532
1940	93	3,750	30,109,130
1942	96	4,507	45,764,802
1944	97	4,821	49,107,432
1945	90	4,979	48,396,502
1946	98	5,006	56,729,620
1947	....	.....	67,000,000

creased 10,000 bbl. per day to 50,000.

The discovery of a new Leduc field with its estimated reserves of at least 50 million bbl. is accompanied by many new problems, construction of a pipe line to the railway and the start of a new refinery at Edmonton. This refinery which was obtained from the U. S. Government at a price of a million dollars will be moved from Whitehorse, Yukon Territory, where it was part of the Canal project.

The Canal projects in northern Alberta and the Alberta tar sands have not proved economic sources.



Rayon & Nylon

Canada's two producers of rayon, Courtaulds (Canada), Ltd., and Canadian Celenese Ltd., together produced over 18 million pounds of acetate and viscose yarn in 1946 which represented an increase over the previous year. However, this was not enough to meet the rapidly growing demand for these materials. The difference was made up by imports from Great Britain and the United States.

At present both firms are expanding facilities. Courtaulds has a 7.5 million dollar program under way and Celanese which invested 2.5 million in new units in 1946, has allocated an additional 3 million for extensions to its main plant at Drummondville, Que. Celanese is also building a 3 to 4 million dollar plant at Sorel, Que., to produce yarn from staple fiber supplied by the Drummondville plant.

C. I. L. has an $8,000,000 nylon yarn plant producing 2,500,000 lb. of continuous filament per year. The nylon salt solution is imported from du Pont's Belle, W. Va., plant.



Paint & Varnishes

This industry has been making great progress and is in the midst of a healthy expansion program. The 1947 sales was over 70 million dollars compared with 59 million the previous year and only 25 million ten years ago. In other words the sales have almost tripled in the decade. During the period the number of paint and varnish plants grew from about 82 to 100.

The majority of producers are small and serve the localities in which they are located. There is a certain amount of specialization in that paint factories near automotive centers concentrate on automobile enamels, those in the prairie provinces on barn paint, and those in the industrial centers on coatings for machinery, ships, and products of heavy industry. Ordinary house paint is produced everywhere and is the most important of all products.

Several new factories are on the way. Announcement was made last year by Pittsburgh Plate Glass Co. that a new factory would be constructed at Long Branch, Ont., on the outskirts of Toronto. This plant would make a complete line of paint, varnish and enamel products. Sherwin-Williams Co. of Canada, Ltd., has completed a 2.5 million dollar expansion program at its Montreal plant. The new production facilities include a synthetic varnish plant. The company is now producing alkyd type resins. And Murphy Paint Co. Ltd. of Montreal is building a new plant in Vancouver, B. C. There are said to be as many as a dozen new plants in process of construction.



Soaps

Canada's soap production to the extent of 85 percent comes from the plants of three companies, Colgate-Palmolive-Peet Co., Ltd., at Toronto, Procter & Gamble of Canada Ltd., at Hamilton, and Lever Brothers Ltd. with plants at Toronto, Ont., Manitoba and Vancouver, B. C. Approximately 40 smaller companies account for remainder of the production which in 1946 amounted to 116,000 tons valued at 27.5 million dollars. About 56 establishments made washing compounds as their main product and about 46 concerns produced cleaning preparations chiefly.

In recent years an important new outlet for soap came from the synthetic rubber industry. It required several million pounds of chip tallow soap in the emulsion polymerization of butadiene.

Just as soon as building restrictions were removed in 1945 several concerns started in on expansion and modernization programs that had been held up. Lever Brothers acquired additional acreage adjacent to its Toronto plant and has announced expenditure of 7 or 8 million dollars on new production facilities. And in Western Canada the Marton Canada Ltd. has established headquarters and is planning to produce a line of cosmetics, perfumes and toiletries.



Pulp & Paper

Pulp and paper is Canada's leading manufacturing industry. No less than three out of every five newspapers printed in the world are printed on Canadian newsprint, it is reported. The industry is important in Canada's national economy especially during the present critical period of American dollar shortage. Robert M. Fowler, president of the Canadian Pulp and Paper Association reports that there are 113 pulp and paper mills in operation in Canada today, employing nearly 50,000 persons on a full time basis and earning approximately 115 million dollars a year. Production of those mills aggregated more than 700 million dollars in 1947, of which more

than 530 million dollars went into export trade. The industry is the largest buyer of electrical power in Canada and is among the largest buyers of farm products and chemicals. The value of gross production in 1946 was 2½ times greater than it was in 1939.

The big developments of the present time are in the West. British Columbia leads all the provinces in the number of new mills planned and capital invested. Improvements being made at established mills in British Columbia, together with the amounts to be spent by new organizations represent a total investment of over $95,000,000.

The unbleached sulphate mill of Bloedel, Stewart & Welch, Ltd., at Port Alberni, B. C., on the West Coast of Vancouver Island recently came into production. For the same Province the H. R. MacMillan Export Co. is planning a 200 to 225 ton kraft pulp mill at a cost said to be $12,000,000.

Celanese Corp. of America's subsidiary, Columbia Cellulose Co., Ltd., has acquired large forest lands in the province of British Columbia, which will supply a mill to be built on Watson Island. The total investment now planned will exceed $25,000,000. This is Celanese's first move into large scale production of cellulose. Production from the plant will be used to supply a substantial share of the company's needs of cellulose for yarns and plastics.

The Comox Logging & Railway Co., subsidiary of Canadian Western Lumber Co. is planning a newsprint mill as well as a pulp mill at Duncan Bay on Vancouver Island. It expects to use as raw material small log debris from cut-over lands. And this is not all for British Columbia for the government has indicated other developments are likely to follow shortly.

In Ontario, Marathon Paper Mills of Canada's new mill at Marathon and Brompton Pulp and Paper Co.'s mill at Red Rock are now at capacity production. Nearby at Terrace Bay, Kimberly-Clark Corp.'s subsidiary Long Lac Pulp & Paper Co. will invest a large sum in a 300-ton bleached sulphate mill. The Government of Ontario is promoting pulp and paper mill construction by its policy of curtailing the exports of pulpwood.

At Newcastle, N. B., the Fraser Companies Ltd. is building a 120-ton unbleached kraft mill which is expected to be in operation some time next year, while there is also a prospect of a combination newsprint and sulphate pulp.

In addition to these and other new mills that are definitely under way, are numerous mills that are under consideration for several provinces. Many established mills have been rebuilt, modernized or enlarged. This means a large addition to the production capacity of the Canadian pulp and paper industry.

It is interesting to note the tremendous increase in production of newsprint by the improvement of machines, as no new paper mills have been built for some 18 years.

Chemists and Engineers

No discussion of the industry would be complete without some mention of the men who make it tick. As of January 1946, the Bureau of Technical Personnel estimates there were 1,765 chemical engineers and 4,795 chemists in Canada. This same bureau of the Department of Labor estimates that in the five-year period commencing in March 1947 the demand for chemical engineers will be 1,100.

Six institutions of higher learning offer degrees in chemical engineering. They are the Universities of British Columbia, Alberta, Saskatchewan, and Toronto, and McGill University and Queens University. From 1920 to 1947 they had 2,500 chemical engineering graduates. During the past college year there were a total of 1,194 students in the chemical engineering departments reports *The Engineering Journal*, pp. 616-17, Dec. 1947.

There is much concern in Canada over the "export of brains," namely the emigration of engineers and chemists from that country. This is particularly unfortunate at this time when there is a growing need for such trained men and women. They are mostly needed for plant work. The research demand is probably not as great for the Canadian companies, being mostly subsidiaries of American firms, depend upon the parent organizations in the U. S. for their research work.

Recently the Chemical Institute of Canada completed a survey of the chemists and chemical engineers with the objective of securing information regarding their economic status, geographical distribution, educational level, types of work, experience and other related matters. The report appears in *Canadian Chemistry and Process Industries*, May 1948. The average male chemist receives a salary of $3,620 and the chemical engineer $4,200. As might be expected most of these men and women were employed in Ontario and Quebec where an equally large proportion of the chemical industry is located. Examination of the ages indicates that the chemical profession is a young one with a median age of 33 years.

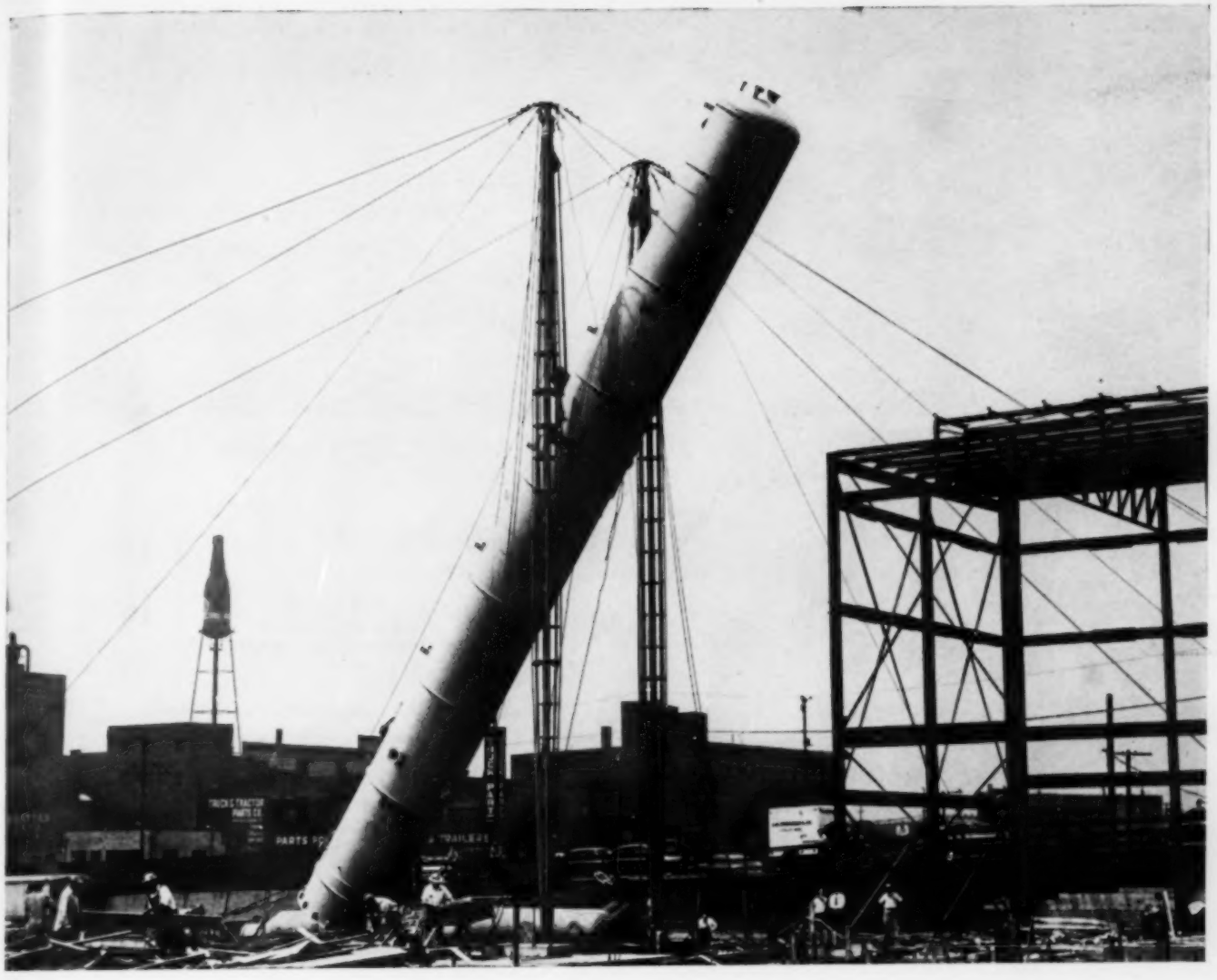
Reprints of this report are available at 35 cents per copy. Address the Editorial Department, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

Comparisons

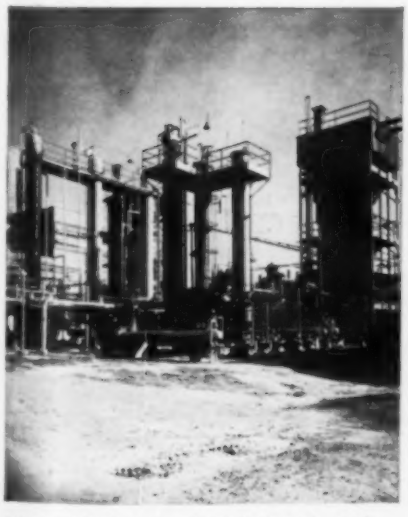
Some comparable Canadian and United States data are of interest. The respective gross value of production for several groups of the chemical process industries are taken for a typical prewar year, 1937, and calculated as a percentage of all manufacturing output and the percentages compared with corresponding ratios in the U. S. The purely chemical manufacturing industry in Canada is at only ⅔ (1.02 to 1.53) of the equivalent U. S. rate. In the field of chemicals and allied products the activity compares favorably (4.11 to 5.46) and in fact is ahead (26.2 to 18.7) in Canada in the chemical process industry group.

The bias in the Canadian chemical industry is therefore in the direction of the chemical processing of primary materials, as might be expected, while many chemical manufactures cannot be manufactured economically, the market not having reached a sufficient volume. As is obvious, the chemical industry depends on other industries for its market and excepting where special facilities in Canada, such as cheap power and low cost raw materials which make export business possible, the chemical industry cannot advance beyond the needs of other manufactures. The entire chemical requirements of the latter are individually small in volume and value compared with the value of their finished products. The chemical materials used rarely exceed 5 percent of the value of industrial products, with certain minor exceptions such as the paint and varnish industry which is nearly 20 percent. In addition they are quite numerous so that many are required in a volume which is below the minimum necessary for economic manufacture in Canada.

The editors wish to express their appreciation for assistance in the collection of data and information concerning the Canadian industry to the Information Office of the Canadian Consulate General in New York, the Chemical Institute of Canada, the Engineering Institute of Canada, the Dominion Bureau of Statistics, and chemical companies and individuals visited in Canada.



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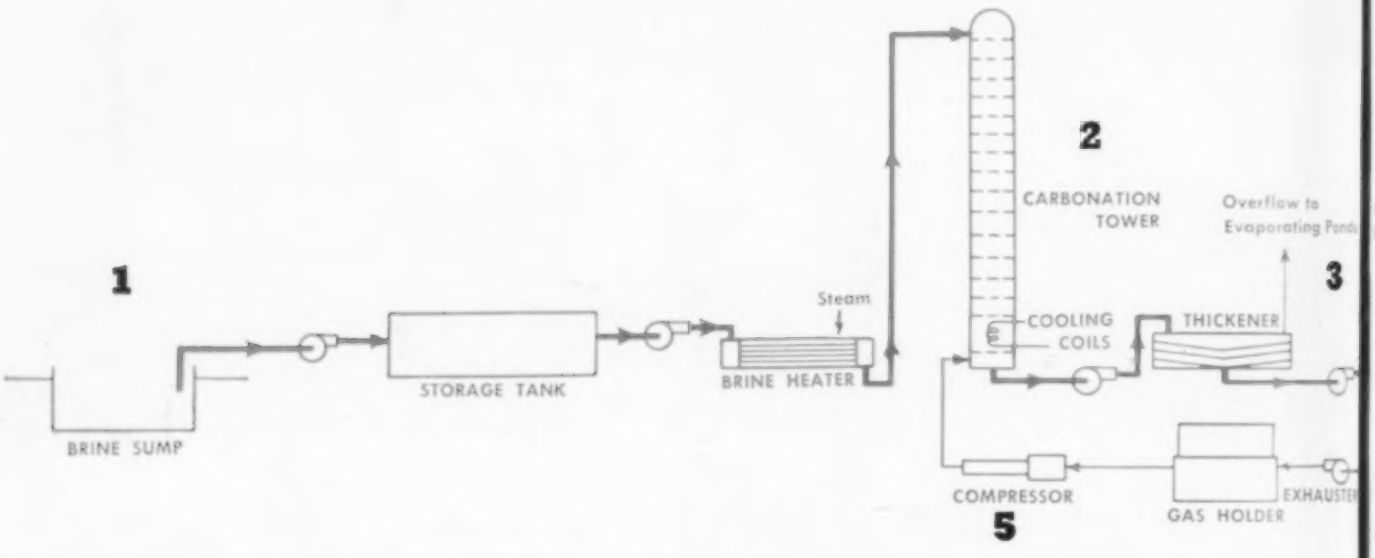
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Designers, Engineers, & Constructors in GAS PROCESSES



1 Here is the sump where concentrated brine from the solar evaporator enters the plant. Visible in the background is the flat plain where solar evaporation takes place, and the 8-ft. concrete wall surrounding the plant.



Soda Ash and Caustic

ARTICLE ON PAGE 96

PICTURED FLOWSHEET

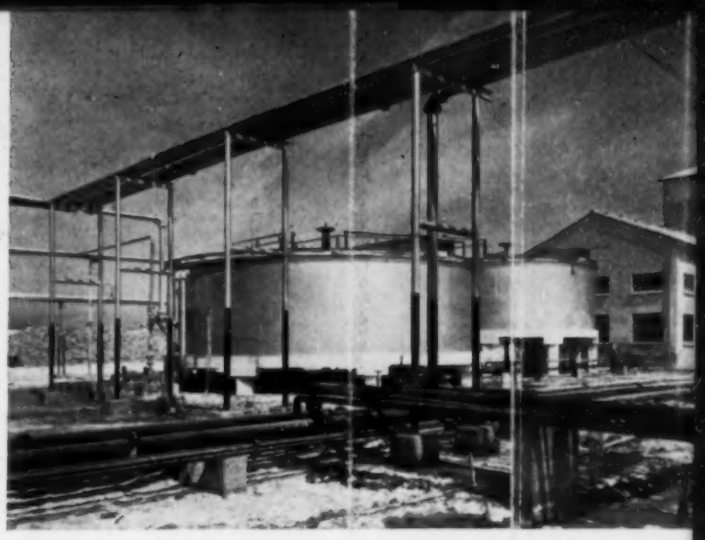
LOCATED some 20 miles from Mexico City, the plant of Sosa Texcoco, S.A., produces soda ash and 50 percent caustic from the brines of Lake Texcoco. Before the brine arrives in the plant it has been concentrated in a huge solar evaporator, called a caracol, built in the form of an inward spiral. As the brine enters the plant it contains about 20 percent salts, primarily sodium carbonate and sodium chloride. The brine is first carbonated with carbon dioxide which reacts with the sodium carbonate to form sodium bicarbonate. The bicarbonate precipitates and is separated from the remaining brine in thickeners and centrifuges. The bicarbonate is then returned to carbonate in two Herreshoff furnaces, the first of which is muffle-type in order to recover carbon dioxide for recycle. In the second the soda ash is given final treatment to remove last bicarbonate traces, and organic impurities, and to improve density. The ash is then stored in concrete silos ready for shipment.

Caustic is made by the aqueous reaction of soda ash and lime. Lime is produced at the plant from limestone and coke in vertical, intermittent-feed kilns. It is then slaked and reacted with soda ash solution in agitated caustifying tanks. Heat supply to these tanks is by direct steam addition. Resulting weak solution contains about 10 percent caustic. Precipitated calcium carbonate is separated from the weak caustic solution in a Dorr thickener and is washed countercurrently with water before being taken to waste. The weak caustic solution is concentrated by vacuum evaporation in a Swenson double-effect unit and is clarified in a bell settler.

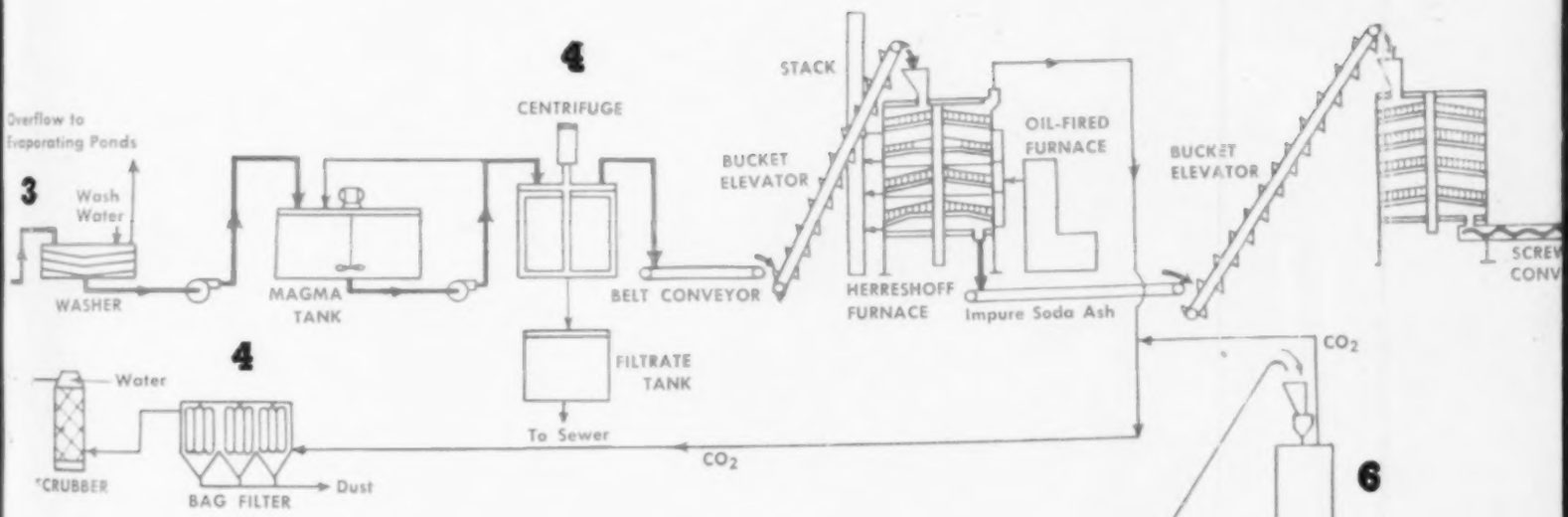
CHEMICAL ENGINEERING
August 1948
PAGES 136-139



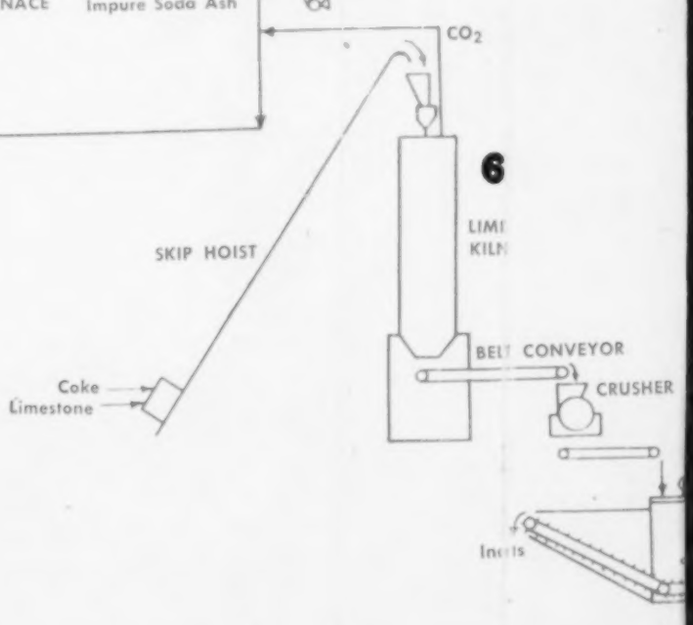
2 In these large towers, brine is reacted with carbon dioxide to precipitate sodium bicarbonate, separating it from sodium chloride.

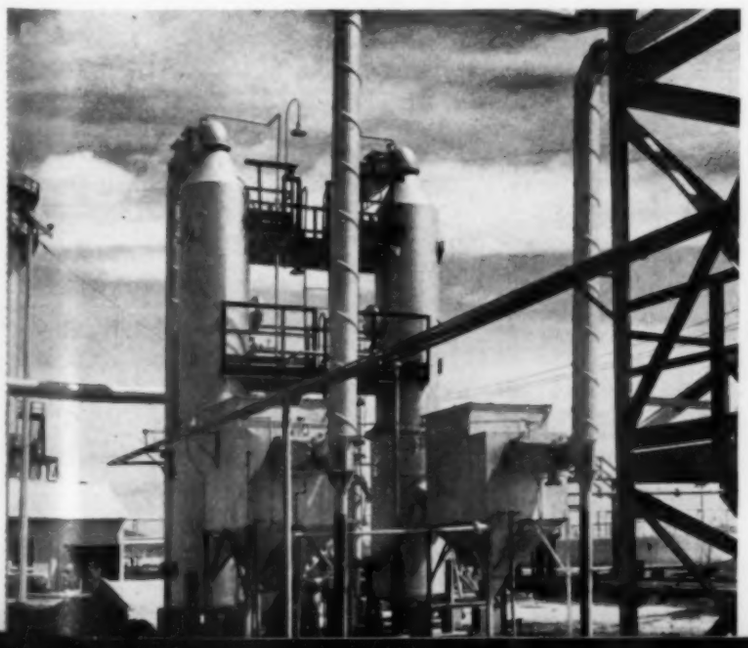


3 In these Dorr thickeners the slurry from the carbonating towe separated into clear brine and solid bicarbonate which is water washed.



5 Carbon dioxide from the Herreshoff furnace is purified in these bag filters and water scrubbers, is compressed, recycled to carbonation.



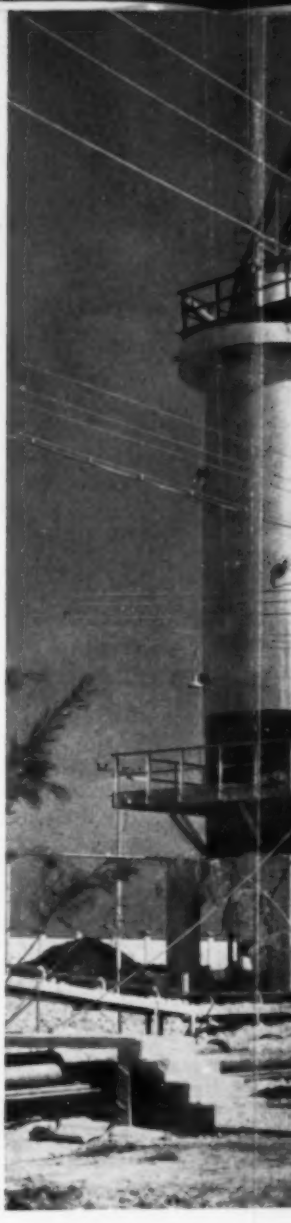




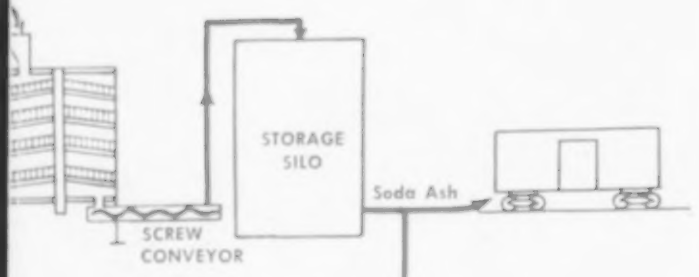
carbonating towers is
is water washed.

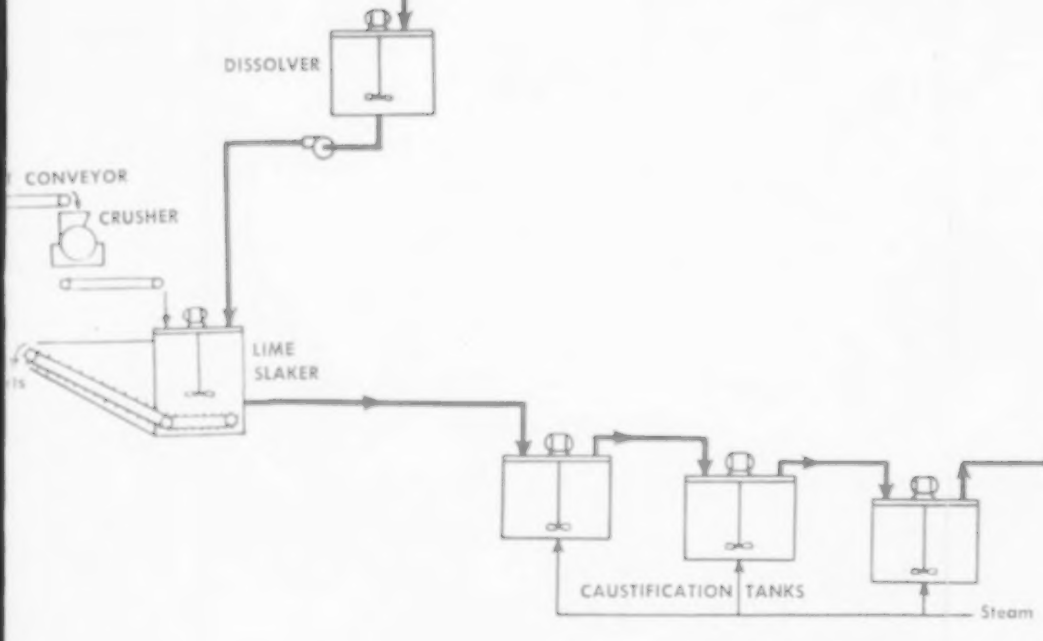


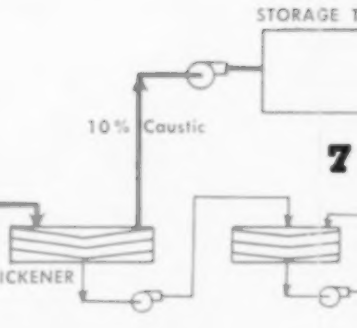
4 Thick slurry from the thickeners is separated in these vertical batch-type centrifuges. Magma tank and filtrate tanks are at the left.



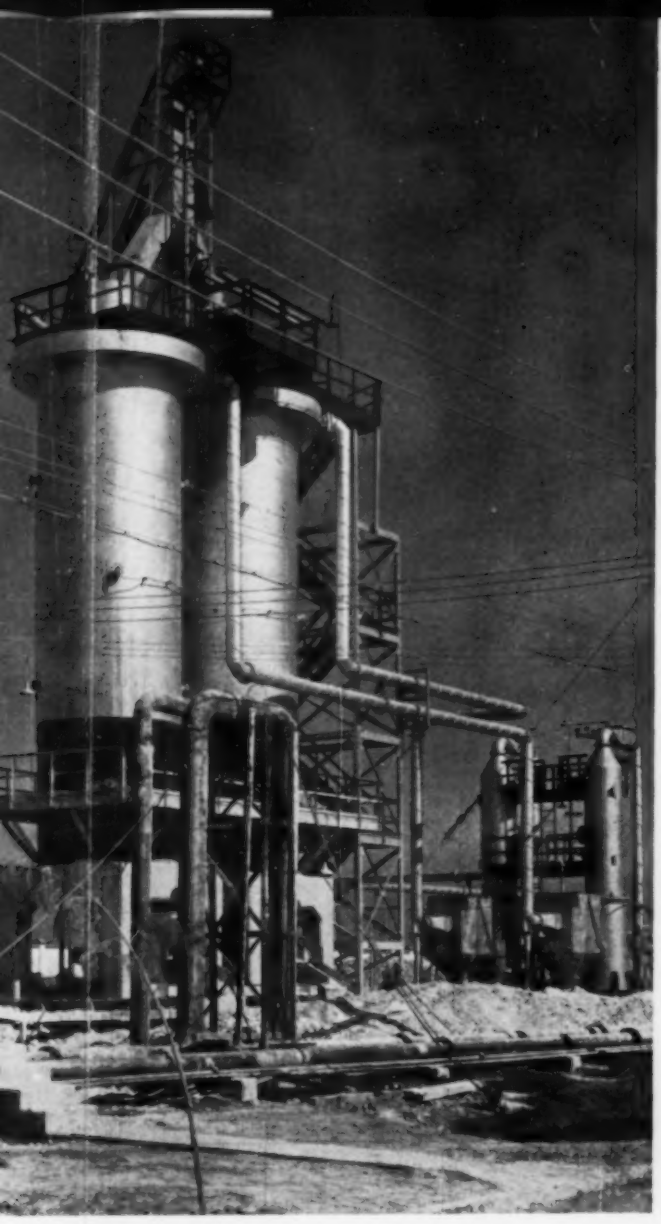
6 Limestone and coke react
is slaked, reacted with soda a



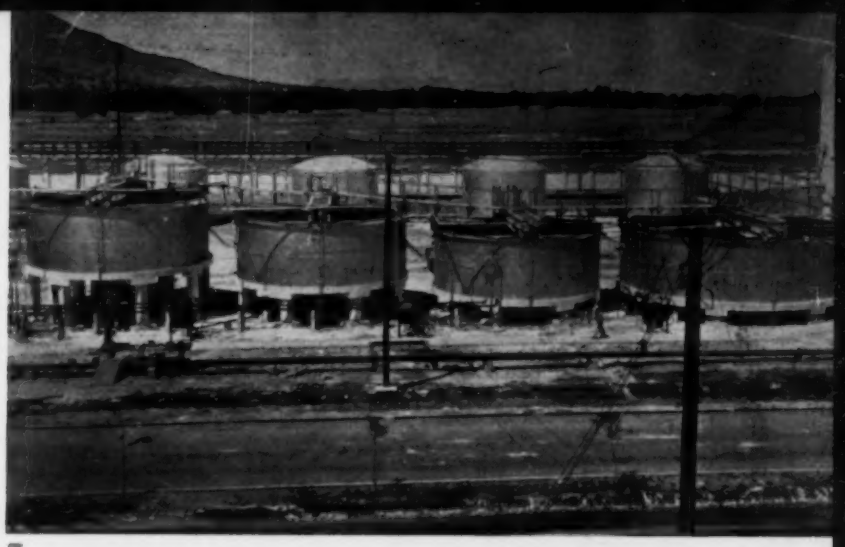




7



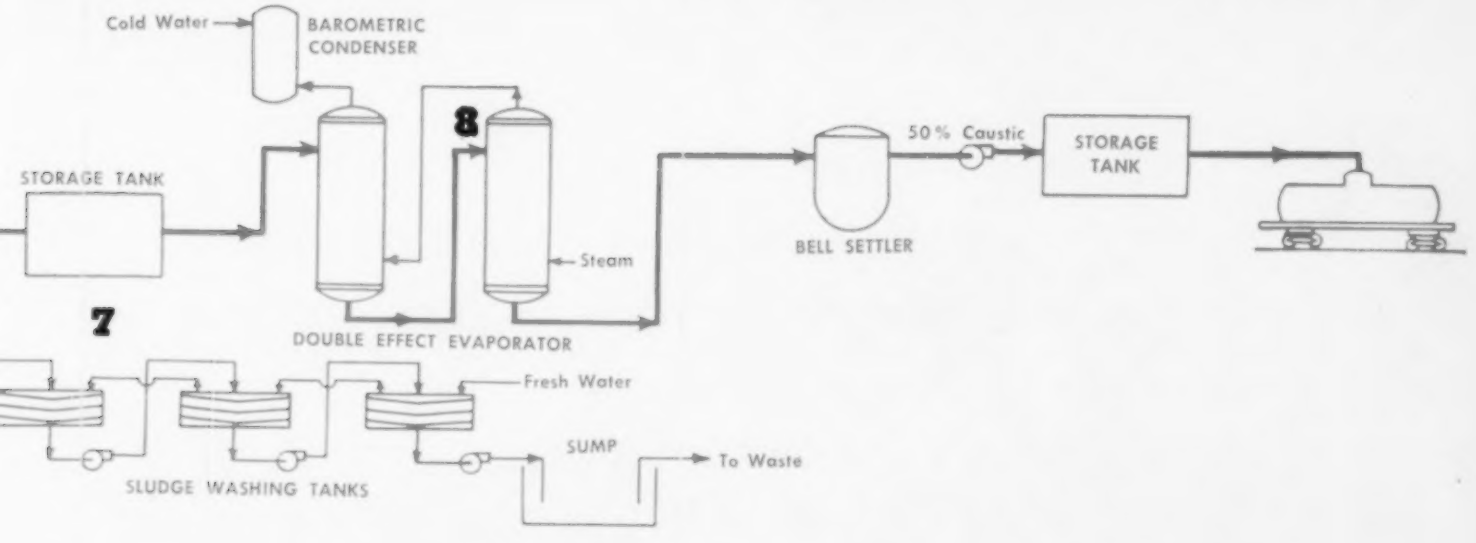
nd coke react in these vertical kilns to produce lime. Lime with soda ash in solution to produce weak caustic.



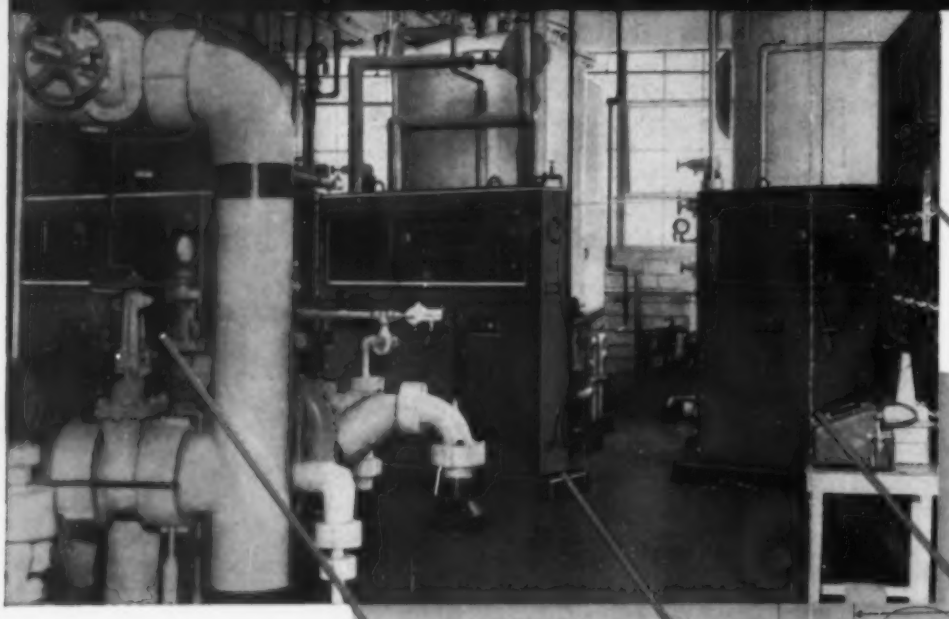
7 Precipitated calcium carbonate is separated from weak caustic in thickener at right, is washed countercurrently in three washers at left.



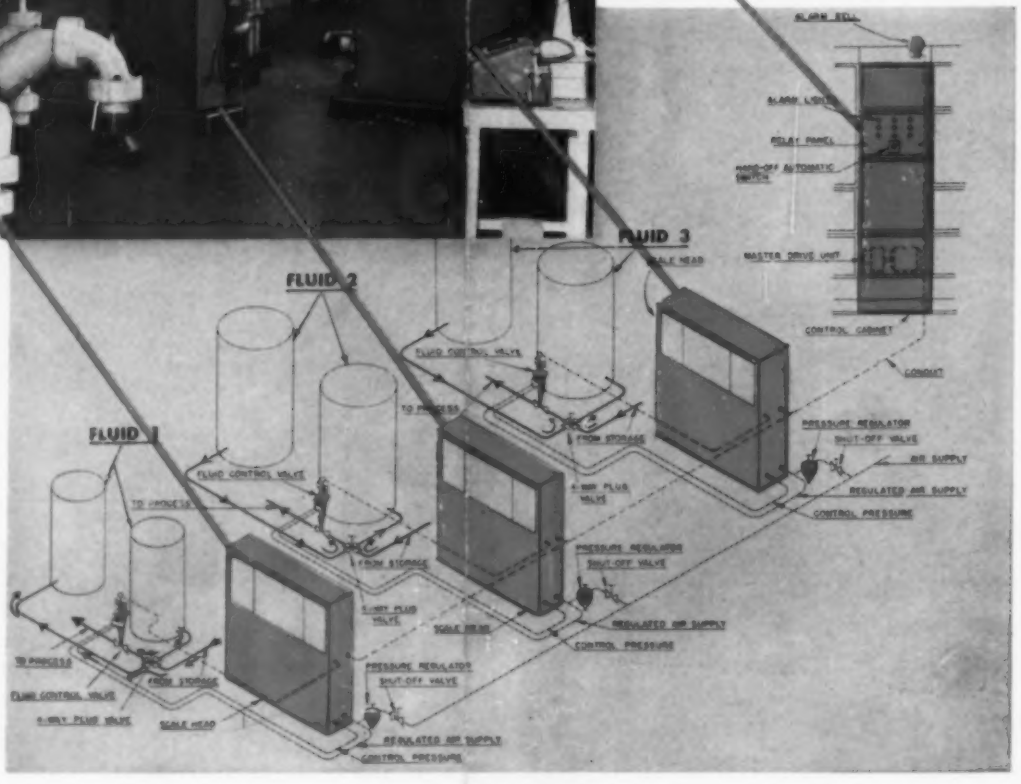
8 Weak caustic is concentrated to 50 percent in evaporators, the bases of which are shown here. Solution is then clarified in a bell settler.



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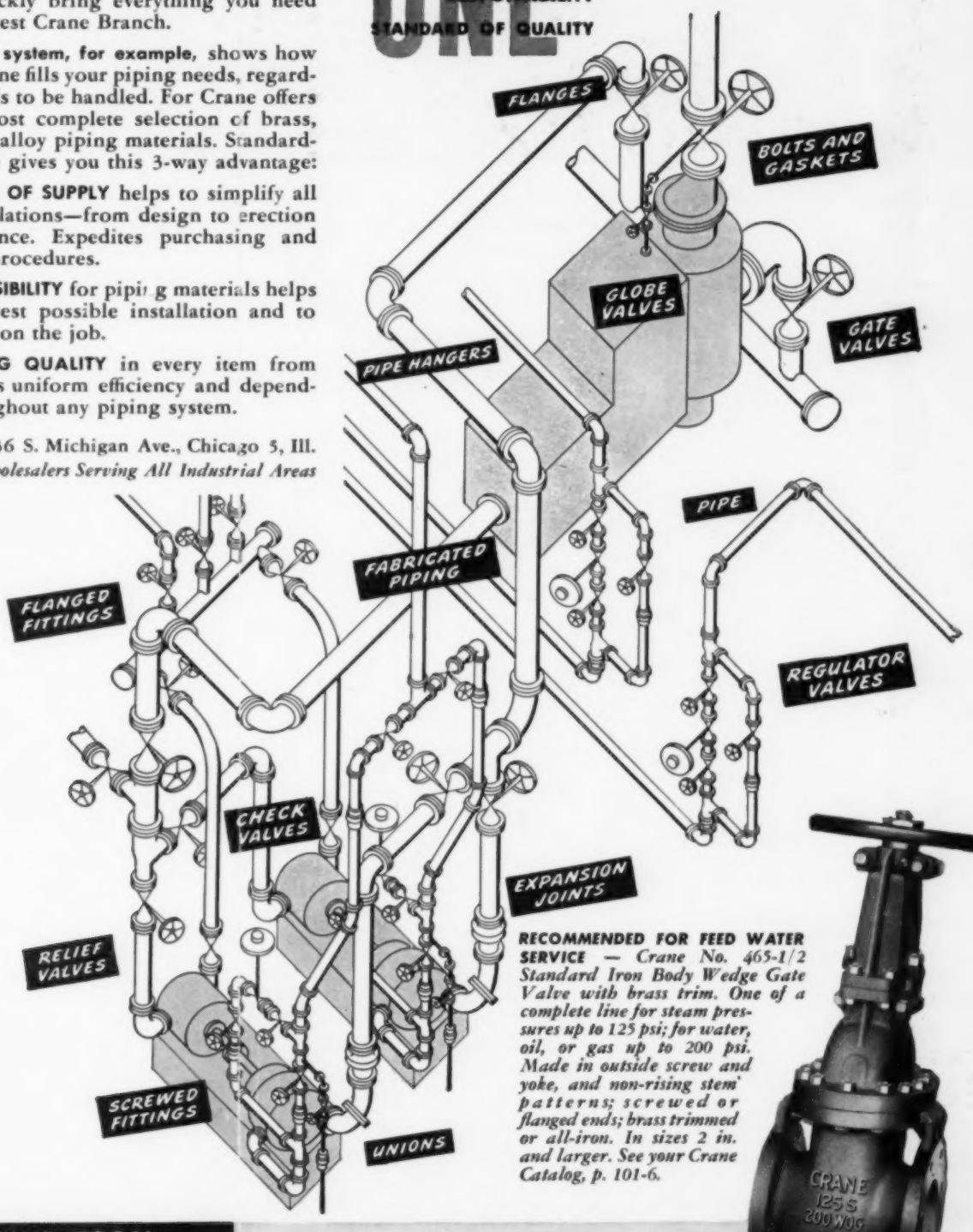
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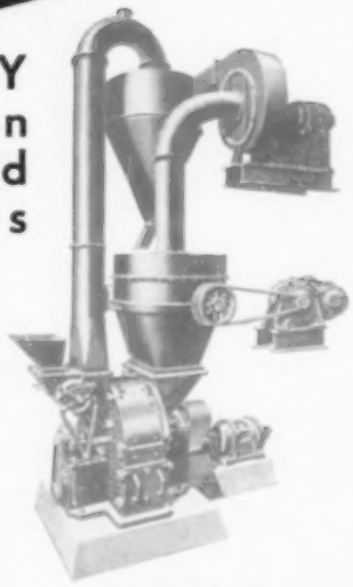
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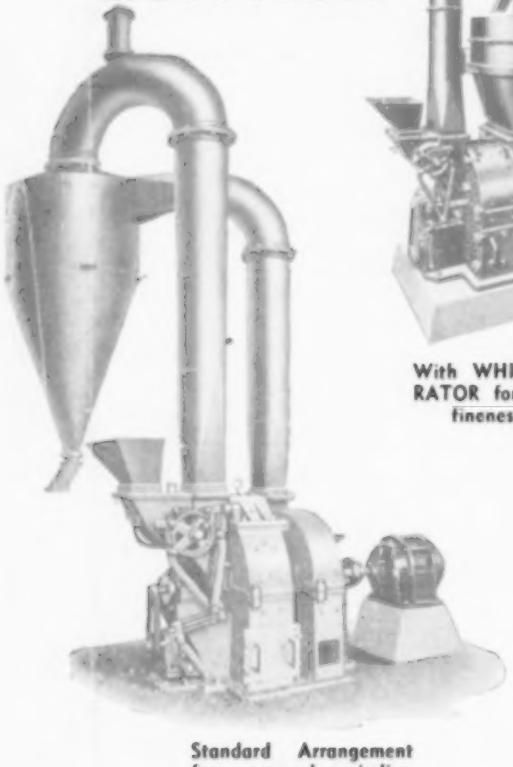
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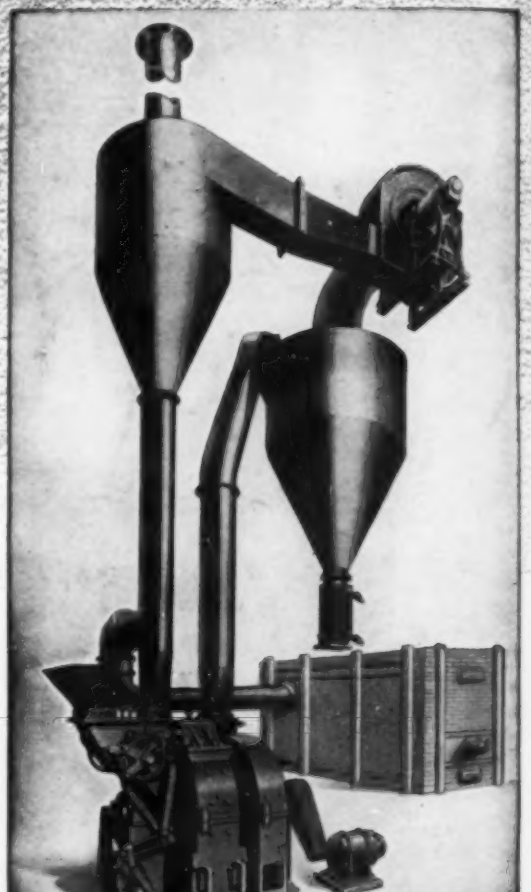
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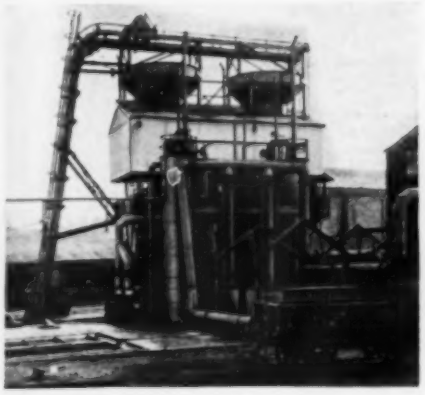
PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

CONTENTS

Angle Skip Hoist	143	Vacuum Pressure Regulator	148
Axial-Flow Pump	143	Inert Packing	148
Temperature Limiter	143	Heavy Duty Magnet	150
Electric Acid Pump	143	Remote Control Servo	150
Sampling Cage	144	Rider-Operated Truck	152
Vacuum Monitor	144		
Equipment Cost Indexes	144		
Float-Sink Concentrator	144		
Pallet Switch Truck	144		
Up-Flow Demineralizer	146		
Centrifugal Molecular Still	146		
Electric Superheater	146		
Improved Sifter	148		

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

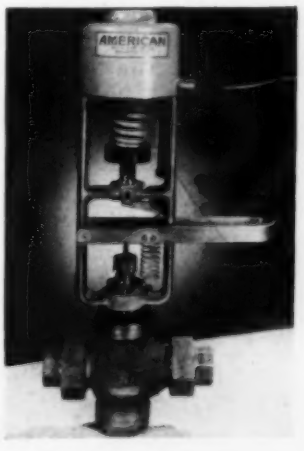


1. Angle Skip Hoist

SUPPLYING two gas producers in the accompanying view is a new type of skip hoist produced by Strachan & Henshaw, Bristol, England, which combines both elevation and horizontal distribution. Hoists of this type are able to distribute horizontally to any number of points along an overhead track. The operation of the skip is completely automatic, being controlled by limit switches and tripping levers which can be pre-set to select the discharge points required. All other operations are also automatic and no attention whatsoever is needed while the machine is in operation. It is set into action by pressing a button and will continue to perform a shuttle service until stopped by the pressing of another button. The combination of vertical and horizontal movement in this machine makes it unnecessary to transfer material from the elevating hoist to some other form of handling equipment, thus simplifying both installation and maintenance. Units of any desired size can be obtained. For example, limestone is being handled by this system at the rate of 100 tons per hour.

2. Axial-Flow Pump

FOR HANDLING large capacities of contaminated seawater and other corrosive liquids, Economy Pumps, Inc., Hamilton, Ohio, has developed a large-capacity axial-flow pump of corrosion resistant construction, particularly suited to the high-speed pumping of large liquid volumes, as in condenser circulation. The impellers and suction bells are cast from 25 percent chrome, 12 percent nickel stainless steel, with shafts of 18-8 stainless. Column and discharge elbows are formed of high-test cast iron containing approximately 2 percent nickel.



3. Temperature Limiter

SNAP ACTION is employed in a new temperature limiting regulator announced for process applications by Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn. Made in sizes of ¼, ¾ and 1 in. for temperatures from 20 to 345 deg. F., this regulator is recommended by the manufacturer for applications where a positive shut-off is required when the critical temperature has been reached. The release mechanism is made of stainless steel to insure sharp, positive and accurate action when the shut-off point is reached. The regulator is placed in operation by simply lifting a lever which "cocks" the snap action mechanism. As soon as the set temperature is reached, this mechanism releases and closes the valve. It remains closed until manually reset by again lifting the lever.



4. Electric Acid Pump

CONTENTS of carboys may be removed quickly with a new electric carboy acid pump announced by the Belke Mfg. Co., 947 North Cicero Ave., Chicago 51, Ill. The pump, operating from any standard electrical outlet, is slipped into the carboy and a self-sealing rubber connection seals the carboy neck. Turning on the motor switch causes a small compressor to build up air pressure in the carboy,

quickly forcing a steady flow of acid out through the pipe. This flow can be stopped instantly by pressing a lever which releases the air pressure in the carboy. A pressure release valve prevents air pressure from going over 30 lb. The only part of the unit in contact with the acid is the pipe itself, which is easily replaceable and is available in lead, hard rubber or saran.



5. Sampling Cage

To HOLD a 32-oz. sampling bottle and thus obtain spot or running samples through an opening of 4⅞ in. or less, the Vapor Recovery Systems Co., 2820 North Alameda St., Compton, Calif., has introduced a sampling cage constructed of non-sparking materials. Operation is simple. It is necessary merely to lower the cage to the desired level and uncork the bottle by slightly jerking on the tape or chain. The device was designed especially for use with this company's gas-tight gaging and sampling units on low-pressure vessels, in lieu of a pressure type sampling bomb.



6. Vacuum Monitor

A NEW type of Skanascope vacuum monitor has been introduced by the Skaneateles Mfg. Co., Syracuse, N. Y. The instrument utilizes a controlled gas-discharge tube as its basic sensing element to give uniformly sensitive results throughout the vacuum range from 10 microns to 1 mm. On dynamic systems the device is said to be able to hold a given vacuum value within plus or minus 1 micron. The device includes separate sensing element, power supply, control panel and relay base assemblies which allow a variety of installation techniques. Many common difficulties in vacuum control are said to be automatically avoided owing to basic simple design and fundamental error-compensating features. Test installations in chemical processing and other applications are claimed to have shown that radical changes in vacuum techniques may be possible because of the monitor's ability to control continuously and accurately any system through remote automatic valve operation, by an automatic graded leak, or by direct actuation of the prime mover.

Cost Indexes for Typical Process Equipment

IN OUR issue of November 1947, pages 124-126, we presented for the first time the Marshall and Stevens indexes for comparative costs of equipment in eight typical process industries and four closely related industries, together with an average index for the 47 different industries, process and non-process, that are regularly covered in this evaluation firm's studies.

R. W. Stevens, partner of this Chicago and Los Angeles firm, described the methods of obtaining the index numbers in that issue, and listed the indexes back to 1913. At intervals we plan to reprint the complete tabulation from 1913 to current date, while quarterly figures will be published henceforth in our February, May, August and November issues. The quarterly indexes will include: "Year Ago," "Last Quarter," and "This Quarter."

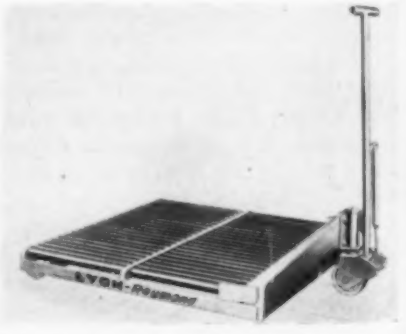
Marshall and Stevens Indexes of Comparative Equipment Costs (1926=100)

Industry	June 1947	Mar. 1948	June 1948
Average of all	147.5	158.4	160.5
Process Industries			
Cement mfg.	140.9	152.0	153.9
Chemical	147.9	160.0	161.9
Clay products	136.2	147.0	148.9
Glass mfg.	138.8	150.1	152.0
Paint mfg.	142.4	153.3	155.2
Paper mfg.	143.6	153.6	155.5
Petroleum ind.	143.3	156.4	158.3
Rubber ind.	147.8	158.8	160.7
Process ind. avg.	145.5	157.4	159.2
Related Industries			
Elec. power equip.	146.6	161.6	163.5
Mining, milling	149.6	160.7	162.6
Refrigerating	159.3	170.6	173.3
Steam power	138.2	148.7	150.6

7. Float-Sink Concentrator

FOR CLEANING coal and the concentration of ores, Link-Belt Co., 307 North Michigan Ave., Chicago 1, Ill., has introduced a new float-sink concentrator which employs a mixture of water and finely ground magnetite as the heavy medium. The system is said to produce a clean float with a minimum of sink material, and a clean sink containing a minimum of float material. It is said to be especially adapted to sharp separations at low specific gravities, the range extending as low as 1.25 sp. gr.

A drum-shaped tank containing the heavy medium and a rotating elevator for the sink material is the heart of the new concentrator. The raw coal or ore is fed into this drum by means of a flume and is immersed in a bath of the heavy medium. The float material rises and passes over a discharge weir and stationary screen which removes most of the medium. The sink material is elevated from the bottom of the tank by means of a rotating wheel to a flume from which it passes to a screen. Both float and sink materials are subjected to water washing to remove remaining heavy medium which is concentrated by magnetic flocculation, thickening, magnetic separation and densification, after which it is demagnetized and returned to the medium circulating system for return to the concentrator. Medium loss is said to be small, and the process also features water conservation by employing closed circuits for both the heavy medium and the washing.



8. Pallet Switch Truck

A SIMPLE solution is now available to the problem of loading pallets inside of freight cars and transferring them to a roller conveyor for move-

5 REASONS WHY you get better values with Pfaudler Stainless Steel Equipment!



Process know-how—By specializing in the fabrication of chemical and food processing equipment for 65 years, Pfaudler has acquired process know-how that pays *you* dividends. It's the reason Pfaudler can offer suggestions which improve the process and increase yields.



Sound over-all engineering—Regardless of the type of vessel you require, there are "good" and "best" ways to build it. Part of the answer is an engineering staff with diversified experience. Such matters as size, pressure requirements, heat transfer, agitation, location of openings, etc., get plenty of attention as they determine the best ways of getting desired results at low cost.



Proper selection of alloys and finishes—Stainless steel is available in many alloys and finishes, the proper selection of which is essential to obtain maximum service life, particularly as related to corrosion resistance.



Engineered agitation—In building equipment for so many industries for so many years, Pfaudler has developed formulae which take the guesswork out of agitation. Whether your process involves gas absorption, emulsification, suspension of solids, etc., Pfaudler specifies the type of agitation and drive that does the job right.



Well equipped shops—Pfaudler workmanship is good, first because of experienced workmen, and second because of well-equipped shops. When stainless steel requires heat treatment to secure better corrosion resistance, Pfaudler's automatically controlled furnaces will take the largest vessels. Passivation is also helpful in improving corrosion resistance. Here again, Pfaudler has the proper facilities.



Summing Up—Users tell us that the life-cost ratio of Pfaudler stainless steel equipment is exceptionally good for the reasons given above. Place your business with Pfaudler now, and prompt deliveries can be made. Your inquiries are invited.



Pfaudler

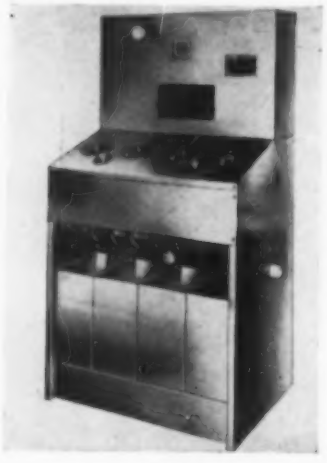
Branch Offices: 330 West 42nd St., New York 18, N. Y.; 111 W. Washington Ave., Chicago 2, Ill.; 1325 Howard St., San Francisco 3, Calif.; 818 Olive St., St. Louis 1, Mo., 63 West Milwaukee Ave., Detroit 2, Mich., 1318 1st Nat'l Bank Bldg., Cincinnati 2, O.; 1041 Commercial Trs. Bldg., Philadelphia 2, Pa., 751 Little Bldg., Boston 16, Mass., 334 Chattanooga Bank Bldg., Chattanooga, Tenn., Enamelled Metal Products Corp., Ltd., Artillery House, Artillery Row, London, S. W. 1, England.

THE PFAUDLER CO., ROCHESTER 3, NEW YORK

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

ment to a warehouse. For this purpose the Lyon-Raymond Corp., 4965 Madison St., Greene, N. Y., has developed a special roller truck in which a large number of small diameter rollers replace the conventional platform. The truck can be moved about inside a freight car or motor truck so that palletized loads can be made up from goods being received. When the pallet is loaded, the truck is moved to the doorway where the conveyor is set up leading to the warehouse. One side of the truck is lined up with the end of the conveyor and the pallet is easily pushed on to the conveyor. Handling is materially reduced compared with the old system in which the goods had to be carried to an empty pallet placed on the conveyor.



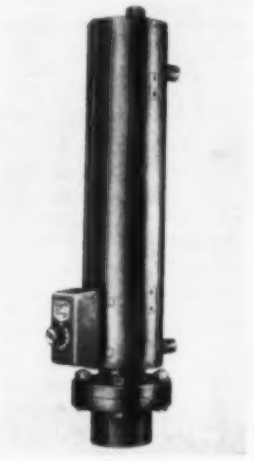
9. Up-Flow Demineralizer

HIGHER PURITY of effluent, lower cost per gallon, and simpler regeneration, are claimed for a new package-type up-flow demineralizer offered by Barnstead Still & Sterilizer Co., 121 Lanesville Terrace, Forest Hills, Boston 31, Mass. It is claimed that the higher purity is secured through the use of improved synthetic resins and through their more efficient use by upward flow of the raw water. The lower cost of operation results, it is said, from the complete elimination of the need for back-washing, due to upward flow, which reduces valve operation and labor costs. Regeneration time is said thus to be cut nearly in half. The unit comes completely assembled, and it is only necessary to connect the water supply and waste to start operations. An ordinary electrical outlet is needed for the indicator lamp.



10. Centrifugal Molecular Still

BASED on the same principles as the large commercial stills used industrially and sold by this company, a small model molecular still for laboratory work is now available for the first time from Distillation Products, Inc., Rochester 13, N. Y. This molecular still employs a centrifugal evaporator and makes possible the distillation of fats, oils and waxes, as well as other high molecular-weight materials which otherwise could not be distilled owing to thermal damage. The conical centrifugal rotor of the evaporator is 5 in. in diameter, and is warmed by an embedded heater. The condenser is formed by a flattened surface of the bell jar inclosing the complete unit. Material to be processed is contained in the bottom of the inverted bell jar, from which it is fed by means of a small circulatory pump on to the center of the rotor. Distilland is in contact with the heated evaporator for only 0.2-0.05 sec. The normal operating pressure of the still is 0.10 to 10 microns. Vacuum is produced by a fractionating oil diffusion pump operating in conjunction with a mechanical pump. The unit is supplied with the necessary meters and controls.



11. Electric Superheater

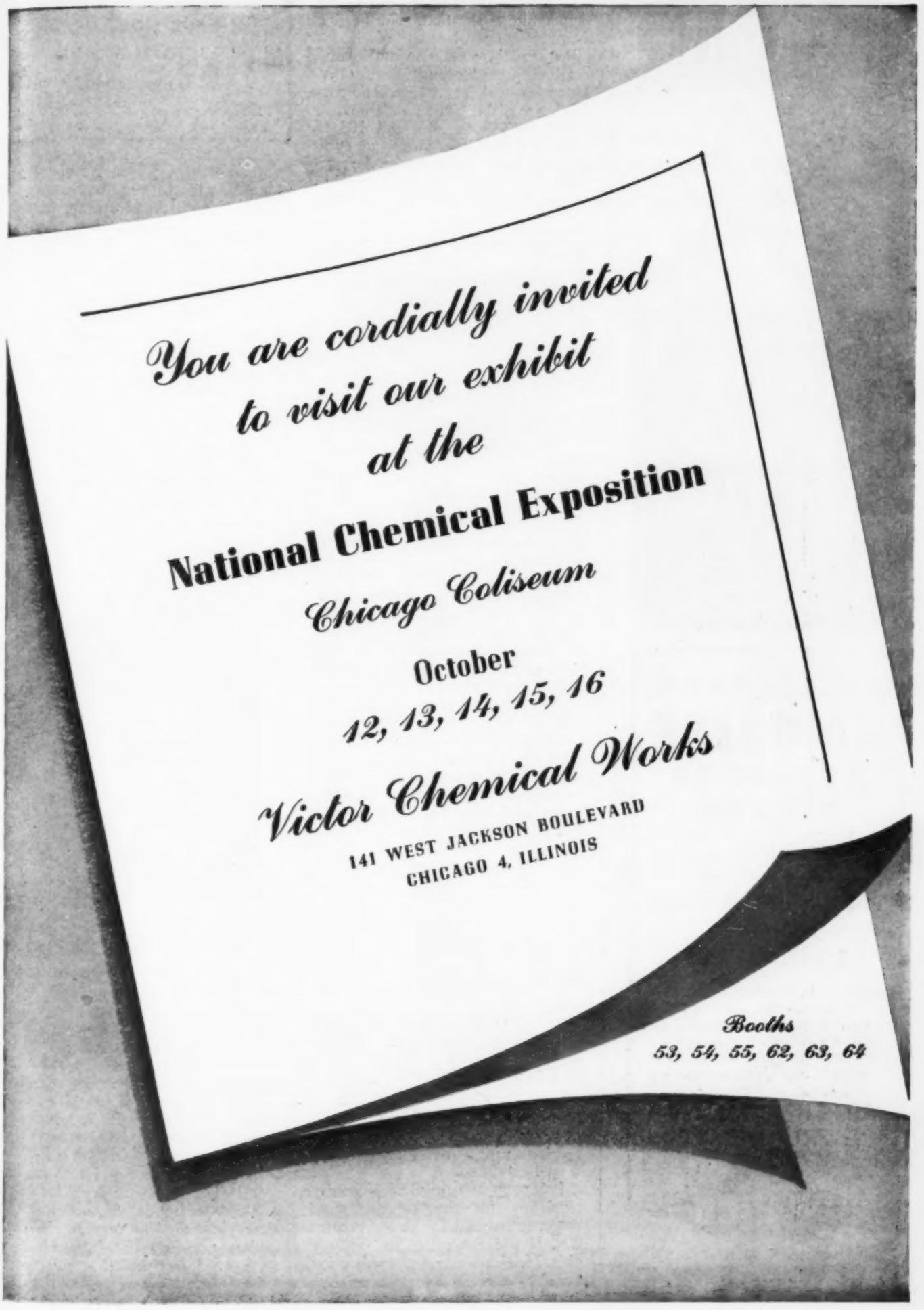
DESIGNED for the superheating of steam and the preheating of air and other gases for process use is a new series of heavy-duty electric heaters offered by Edwin L. Wiegand Co., 7514 Thomas Blvd., Pittsburgh 8, Pa. Offered under the trade name of Chromalox, these heaters are suitable for temperatures up to 750 deg. F., or higher, with operating temperature reached rapidly and accurately maintained by thermostatic control. The heaters are produced in three sizes, Series 2, with 2-in. standard pipe, Series 3 with 3-in. standard pipe, and Series 6, with 5-in. standard pipe. Capacities range from 1 to 12 kw. Two or more heaters may be connected in series for larger capacities.

In accompanying view, steam, air or gas enters through the lower pipe connection, passes upward through the larger steel pipe chamber, and flows out through the upper pipe connection. The heating unit is of the electric tubular type, available in either



Tank Trailer Handles 3,200 Gal. Per Load

Eli Lilly & Co., Indianapolis, is now employing this Fruehauf tank trailer to carry many thousands of gallons of penicillin broth per day between two of its plants. The double-tank trailer, of unusual design, carries 3,200 gal. per load and does a job practically equivalent to a pipeline between the two plants.


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FOR FILTRATION, PLASTIC REINFORCEMENT AND OTHER INDUSTRIAL USES

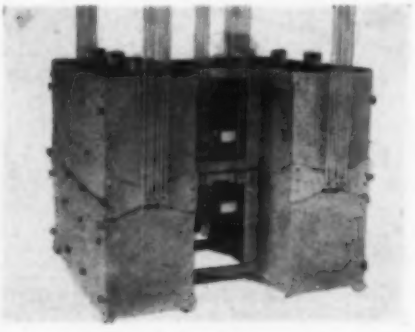
Amosite is an extremely long acid resistant asbestos fibre mined in South Africa. It is especially suitable for filtration and similar processes. Available in various grades and degrees of opening to meet specific requirements.

UNION ASBESTOS & RUBBER CO.

UNARCO

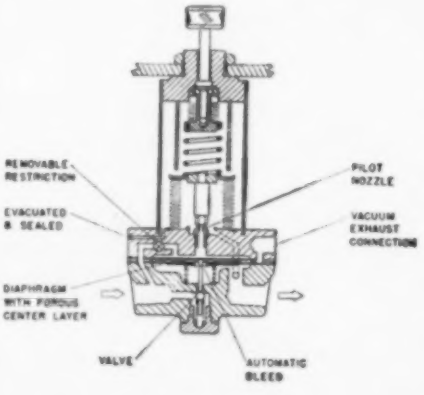
1821 S. 54th AVE., CICERO, ILL.

steel or alloy sheath, depending on temperature application. The heating chamber is constructed of heavy-walled seamless steel pipe and is completely insulated against heat losses. A number of different automatic controls are available. The standard range is 200 to 550 deg. F., and 100 to 1,000 deg. F. Other ranges are available on request. Units can be provided for voltages ranging from 115 to 550.



12. Improved Sifter

A NEW series of high and low speed sifters incorporating a new idea in sieve clamping devices is now being offered by the Wolf Co., Chambersburg, Pa. This sifter, designated as the Wolf LB sifter, is made in two, four and six sections with varying numbers of sieves stacked in each section. The sifting action is accomplished by swinging in a perfect circle. The free-swinging drive is said to give perfect circle action without strain on the sifter boxes. The machine can be provided with either angle gear transmission or a motor drive. Each section of the sifter box is equipped with the newly designed sieve clamping device.

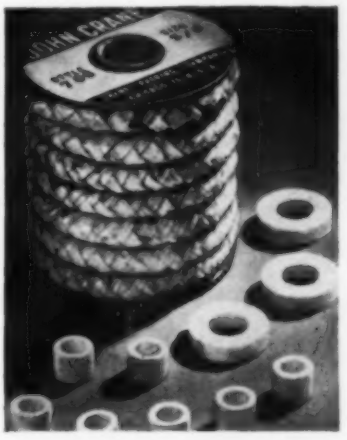


13. Vacuum Pressure Regulator

INCLUDED in a new line of pressure regulators for the sub-atmospheric range, introduced by Moore Products Co., H and Lycoming Sts., Philadelphia 24, Pa., are several models with a variety of features for different sorts

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

of applications. All types have a maximum capacity, with atmospheric supply and critical pressure drop, of approximately 1 std. cfm. They are designed to hold constant set values, regardless of changes in flow as well as variations in supply pressure, and employ the pneumatic null balance system in which the main valve is operated by a pilot nozzle. Two models have an automatic bleed making them suitable for dead-end service, as well as flow and reverse-flow service. Two models, for continuous flow applications only, do not have the automatic bleed. Either type can be provided with barometric compensation for regulating at absolute pressure values. For dead end service the instruments have a regulated pressure range from 1 to 20 psia. and for continuous flow service, from 0 to 20 psia.



14. Inert Packing

TEFLON PACKINGS, produced under the name of Chemlon, are now available in a variety of forms from the Crane Packing Co., 1800 Cuyler Ave., Chicago 13, Ill. Unaffected by any solvent, acid or caustic solution at temperatures up to 690 deg. F., the packings are produced for valves, centrifugal and rotary shafts, reciprocating rods and other purposes. Round cross-section, braided, spool-form packings are available in sizes of $\frac{1}{8}$ to 1 in. on spools. These come in types for temperatures to 300 deg. F., and temperatures beyond 300 deg. F. Where endless rings can be installed, the company is now producing solid Teflon rings made in two types, one with-

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for electrical installations that are exposed to
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The illustrations show a representative selection from the hundreds of CONDULETS that are vaportight or when furnished with covers and gaskets become vaportight.

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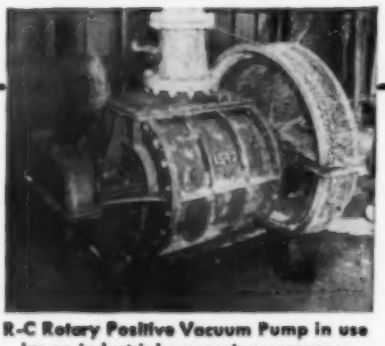


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You'll get outstanding performance, too, from R-C Vacuum Pumps and Meters. That's the result of 94 years of experience, plus the advanced thinking of alert engineers and designers.

So, for any problem of moving, mixing or measuring gas or air, consult R-C *dual-ability*.

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ROOTS-CONNERSVILLE ROTARY CENTRIFUGAL — BLOWER BUILDERS R-C SINCE 1854

BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

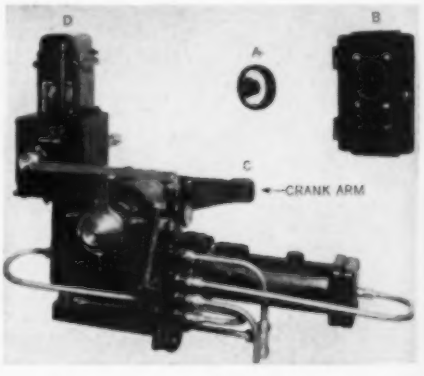
• • ONE OF THE DRESSER INDUSTRIES • •

out lubricant, and one impregnated with graphite throughout its fibrous structure.



15. Heavy Duty Magnet

KNOWN as the "Giant," a new permanent magnet separator for handling fast moving and large tonnages of bulk chemicals has been announced by the Eriez Mfg. Co., Erie, Pa. The new magnet is said to be about twice as strong as the strongest previously commercially produced. The effective range for the removal of tramp iron is 4 to 5 in. Face plates are built of abrasion resistant steel, in a flat or stepped pole face. The two types are supplied, one for stationary installations and open chutes, the other (equipped with hinges and latches) for enclosed chutes. Both models are fully insulated for installation in steel. These magnets are available in sizes from 6 in. up and can be built in any width to give magnetic protection to the full width of the conveying line.



16. Remote Control Servo

THROUGH new equipment offered by Askania Regulator Co., 240 East Ontario St., Chicago 1, Ill., it is now possible to position hydraulic cylinders with power output up to 7,500 lb. at distances up to 1,000 ft. from the remote control station, with a cylinder movement accuracy claimed to be 0.1 per cent. This company's new standard control units are combined to produce this result, taking as the actuating factor either a manual adjustment or the small electric signal given by a temperature, pressure, flow, or other instrument. The device, as indicated in the accompanying view, includes: A, the remote transmitter station; B,

How industry makes multiple savings with Gulf Quality Oils and Greases:



Cutting costs in **NYLON HOSIERY MANUFACTURE**

IT costs money to shut down 27,000 nylon twister spindles once a week to clean sludge out of the bases and change oil. But a modern nylon throwing plant found it necessary because the spindle oils they were using wouldn't stand up at 14,000 r.p.m. spindle speeds. Even with this frequent maintenance, spindle wear was excessive.

That was before a Gulf Lubrication Engineer was brought into the picture and recommended Gulfgem Oil, the world's finest spindle lubricant. Now, no sludge, no excessive wear. Oil change period now every six weeks, instead of every week —and then Gulfgem is clean and clear! Production increased, costs down!

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the transmitter and amplifier station; *C*, the hydraulic crank type cylinder; and *D*, the receiver mounted on the cylinder. The position of the cylinder crank arm can be selected at either control station *A* or station *B*. An electric signal of the position selected is transmitted to the receiver motor *D*, which operates a pilot valve positioning the crank arm at any point within its 90-deg arc. The output position can be selected manually or, with minor modification of the system illustrated, can be selected automatically.



17. Rider-Operated Truck

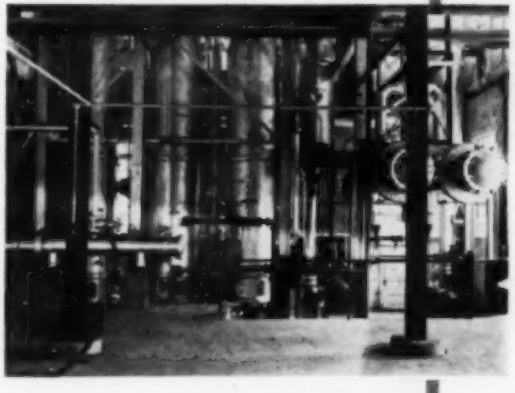
LATEST in the line of small electric lift trucks is the Load-Mobile offered by Market Forge Co., Everett 49, Mass. Where the trend has recently been toward development of such trucks for control by a walking operator, the new truck, which is substantially the same size, carries its operator on a seat which rotates around the steering post so that the operator may either face the load or precede it. For short hauls the operator stands on a folding step, facing the load. For longer hauls, when it is convenient to face away from the load, he can swivel the seat and straddle the mechanism. Or, for negotiating narrow aisles or other difficult spots, he may use the seat and face toward the load. The truck is provided with two speeds, controlled by a foot pedal with a "deadman" mechanism to apply the brake the instant the operator's foot is removed from the pedal.

The unit is of the lifting platform type in standard lift truck heights of 6, 7, 9, and 11 in. lowered, and a full lift of 4 in. for all models. Capacities of 3,000 and 5,000 lb. are available, with 20 percent guaranteed overload









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PULVERIZERS · BREAKER MILLS · ROLLER MILLS · BURR MILLS · HAMMER MILLS
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capacity. Speed is 3½ mph. for the smaller, and 3 mph. for the larger model.

Equipment Briefs

18. Both easy reading of 16 mm. microfilm, and its copying on photographic paper in less than two minutes without the use of a dark room, can be accomplished by means of a new microfilm reader developed by the Scientific Instrument Division of American Optical Co., Buffalo, N. Y. The complete unit occupies only 16 x 23 in. of floor space and weighs but 70 lb. Its texture-free projection screen is 12¼ in. square and shows no "hot spot" so that eye fatigue is said to be minimized. Illumination is controlled accurately by means of an iris diaphragm.

19. For the care of industrial burns Pharmaceutical Preparations, Inc., 11 Niagara St. Bldg., Buffalo 2, N. Y., has introduced a new ointment known as R-52. One large concern with five plants has reported a 78 percent reduction in lost time from burns as a direct result of using the new material which is said to give quick relief equally effective on both heat and acid burns. The results are achieved, it is said, by the drugs used, rather than by the older method of excluding air from the burned surface.

20. For both laboratory and light production filtering, Chemiquip Co., 12 Vernon Ave., Newark 8, N. J., has developed a miniature single-leaf filter press with 98 sq. in. of filtering surface. Only one filter cloth is needed and no holes need to be cut because the slurry feeds directly into the frame, which has an average thickness of 1½ in. The filter is made in bronze or stainless steel and comes complete with stand, pump, bypass, drip pan and pressure gage. The pump motor is not included.

21. Pressures up to 1,500 psi. can be handled with a new solenoid shut-off valve for non-corrosive gases and liquids, now offered in the ¼ in. size by Automatic Switch Co., Orange, N. J. The normally closed valve uses a forged brass body with stainless steel trim. A variety of electrical characteristics can be had.

22. Designated as Series 100, a new line of small natural-draft cooling towers for capacities from 4 to 36 tons of refrigeration has been announced by the Marley Co., Kansas City 15, Kan. Performance is said to be of a kind previously available only in large towers. The towers are prefabricated and shipped knocked down with


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East Moline, Illinois
In Canada: American Machine and Metals (Canada) Ltd.
219 St. James Street West, Montreal 1, P.Q.

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Coupon on pages 159-160

every piece marked, using heavy California heart redwood, with all hardware galvanized. The spray system is designed for maximum break-up at lowest pressure and is said to give a balanced spray in all areas in the tower.

23. A LOW-PRICE cartridge-type water demineralizer intended primarily for laboratory use has been announced by the Penfield Mfg. Co., Meriden, Conn. This device can be attached directly to an ordinary water tap to provide the equivalent of distilled water. The unit employs four beds of ion exchange resins in series and is equipped with an electrical resistance indicator to show when a new cartridge is needed.

24. FILTRATION of a variety of chemicals and other liquids in capacities to 1,000 gph. (or larger in multiple units) is the function of a new multiple-plate pressure filter offered by Mercury Cleaning Systems, Inc., 549 West Washington St., Chicago 6, Ill. Instead of the usual hand-wheel arrangement for clamping the lid, the new filter employs a spring ring clamp which is tested to 120 psi. hydrostatic pressure. The clamp ring can be removed quickly and not only simplifies inspection of the filter but reduces weight of the lid to only 10 lb. Filter plates, frames and lining can be furnished to resist action of various corrosive liquids.

25. A SIMPLE device for gaging liquids stored in 55-gal. drums is being produced by Mastercraft Products, 60 South St., Boston 11, Mass. This device is a gage glass of cellulose acetate butyrate attached to a threaded fitting which is screwed into one of the end openings of the drum. The drum, when stored on its side, can then be gaged by the height of liquid in the tube, the level being clearly indicated by a red cork float. A standard drum faucet may be screwed into the gage fitting for withdrawing contents of the drum.

26. A NEW LINE of steel pallets built of grating bars set on edge has been announced by Kerlow Steel Flooring Co., 222 Culver Ave., Jersey City 5, N. J. The pallets are designed for construction.

. . . NOW

ARMORED VALVES

IN THE LAPP LINE OF VALVES OF

SOLID PORCELAIN

Now . . . the famous Lapp Porcelain valve—with the porcelain body *completely encased in armor*. Genuine Lapp Porcelain, armored, offers greater economy and better operating security than expensive alloy or lined valves. Armor is high-strength heat-treated silicon aluminum; standard 125 lb. flanges integral with the armor. These new designs make more complete, and more useful, the line of Lapp Porcelain valves, which in hundreds of "trouble spot" installations have provided "the only completely satisfactory answer to the problem of corrosion and contamination." Write for complete specifications. Lapp Insulator Co., Inc., Process Equipment Division, 332 Maple Street, Le Roy, New York.



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CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS

PULSAFEEDER CHEMICAL PROPORTIONING PUMPS



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GRINNELL CONSTANT-SUPPORT HANGER

the ONLY constant-support pipe hanger

- provides constant support to piping subject to vertical movement—in all "hot" and "cold" positions.
- maintains full safety factor in supporting high temperature, high pressure piping.
- Non-resonant, energy absorbing.
- Mass-produced from standard precision parts.
- Individually calibrated for each installation.
- Load-adjustment features incorporated into design.
- Three models meet entire range of load-travel specifications.
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In one of the largest catalytic cracking plants for gasoline, Grinnell Constant-Support Hangers provide constant support for trunnion-supported vertical piping weighing 8,000 lbs. with 4" vertical movement at 1100° temperature.

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PROCESS EQUIPMENT NEWS

See pages 143-152

Angle Skip Hoist 143
Axial-Flow Pump 143
Temperature Limiter 143
Electric Acid Pump.....143
Sampling Cage 144
Vacuum Monitor 144
Equipment Cost Indexes 144
Float-Sink Concentrator 144
Pallet Switch Truck 144
Up-Flow Demineralizer 146
Centrifugal Molecular Still 146
Electric Superheater 146
Improved Sifter 148
Vacuum Pressure Regulator.....148
Inert Packing 148
Heavy Duty Magnet 150
Remote Control Servo 150
Rider-Operated Truck 152

NEW PRODUCTS & MATERIALS

See pages 163-170

Ion Exchangers 163
Fungicide 163
Aqueous Colloidal Carbons.....163
o-Chlorobenzotrifluoride 163
Injectible Penicillin 163
Zirconium Metal 164
Insulating Varnish 164
Insecticide Base 166
Safety Film 166
Plastic Specialties 168
Pharmaceuticals 168
Adhesive 170
Bakelite Polyethylene 170

MANUFACTURERS' PUBLICATIONS

See also pages 292-296

101. Process Equipment. General American Transportation Corp., Chicago, Ill.—20-page booklet illustrating and describing the process equipment made by this company. Includes information on steel and alloy fabricated equipment, gas

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holders and vapor seals, thickeners, rotary dryers, filters, evaporators, agitators, etc.

102. Chemicals. Harshaw Chemical Co., Cleveland, Ohio—32-page booklet listing all chemicals available from this company. Includes a brief history of this concern and describes its major activities.

103. Pipes and Tubing. Copper and Brass Research Association, New York, N. Y.—48-page pipe and tube-bending handbook, 3rd edition. Booklet gives in considerable detail information on practical methods for bending pipes and tubes made of copper, brass, and related alloys. Contains a description of various types of pipe-bending equipment.

104. Water-Treating. The Permutit Co., New York, N. Y.—Bulletin No. 2418 contains 12 pages describing and illustrating the water-softeners and dealkalizers made by this company. Principles of operation are discussed and various arrangements of ion exchange units are diagrammed.

105. Fire Protection. Ansul Chemical Co., Marinette, Wis.—20-page catalog features the dry chemical fire extinguishers made by this company.

106. Crushers. The Traylor Engineering & Mfg. Co., Allentown, Pa.—Bulletin No. 5112 is a 30-page illustrated booklet describing the Type TY reduction crusher made by this company. The cut-away view shows details of assembly.

107. Tube Fittings. Tri-Clover Machine Co., Kenosha, Wis.—Catalog 847, 24 pages of data on physical characteristics, fabrication and adaptability of flanged type conical end fittings to other fitting types. Contains a good deal of general information on the use of these fittings.

108. Conveyors. The Jeffrey Mfg. Co., Columbus, 16, Ohio—48-page catalog No. 803 describing the spiral conveyor made by this company. Details of construction of the various models are shown and such information as specifications, as well as dimensions and weights are given. A list of some of the materials that can be handled with this equipment is given.

109. Chemicals. Hercules Powder Co., Wilmington, Del.—20-page booklet containing a list of the products made by this company classified by family groups as follows: cellulose synthetic resins, rosin, terpene solvents and chemical, chlorinated products, dairy products, explosives and sporting powders. The products are briefly described as to chemical compositions, uses, and potential applications.

110. Gas Cylinders. Taylor-Wharton Iron & Steel Co., New York, N. Y.—16-page booklet illustrating and describing the seamless high-pressure gas cylinders for all fixed and liquified gases. Details of construction of the various types of cylinders are illustrated in diagrams, while the dimensions, pressures, and other data are tabulated.

111. Hammer Mills. The Heil Co., Milwaukee, Wis.—4-page leaflet illustrates and describes the hammer mills made by this company.

112. Process Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin B-6057 is a 32-page directory of products and engineering literature available from this company.

113. Instruments. Automatic Temperature Control, Inc., Philadelphia, Pa.—7, 2-page leaflets illustrating and describing different parts of different units of an instrument system. Included are data sheets on pick-up transmitters, pressure transmitters, flow transmitters, standard receivers, and auxiliary equipment.

(Continued on page 292)

These are good for items in this issue only and must be returned by October 31, 1948.

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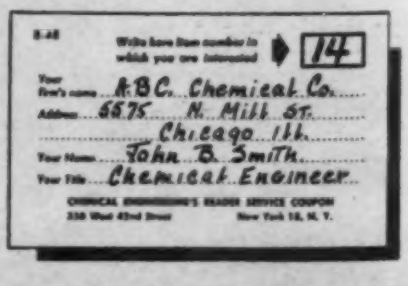
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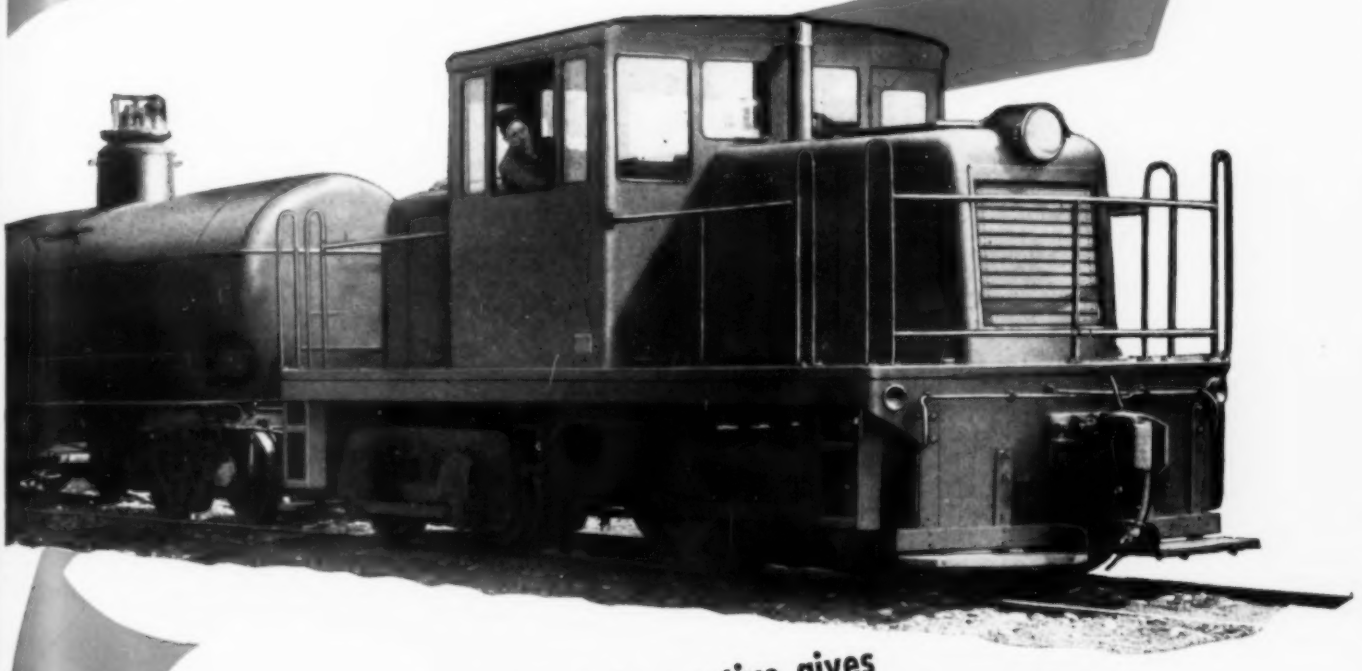
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G-E 50-ton diesel-electric locomotive gives zinc smelting plant dependable, low-cost performance

Total operating and maintenance costs for the G-E industrial locomotive at a large zinc smelting plant in western Pennsylvania amount to only 47 cents an hour, excluding wages of engineer and brakeman. At present this money-saving 50-tonner operates seven days a week, twelve hours a day; but if the plant ever needs additional switching capacity, the locomotive can almost double these working hours. It is ready to work nearly 98 per cent of the time, or over 23 hours in every 24.

LITTLE MAINTENANCE REQUIRED

During the three years the 50-ton switcher has been in operation it has needed little or no mechanical maintenance. The engineer makes his daily inspections between switching assignments. Refueling is required only once every six days, whereas the gasoline locomotive which it replaced was out of service every day for this same operation. *Compare this performance with that of your own locomotive.*

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You can reduce switching costs in your own plant with any of the five standard G-E locomotives which handle virtually all types of industrial switching jobs. They usually save thousands of dollars a year when replacing old locomotives, often pay for themselves in two or three years.

But you don't need to guess what your savings will be. Without obligation a transportation specialist will examine your plant's requirements, estimate your savings in advance. Call your nearest G-E representative today. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

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In plants where fire hazards exist, G-E locomotives provide safer switching for there are no dangerous sparks, no hot ashes.

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Specific Gravity: 1.118 to 1.120 at 20°C./20°C.

Acidity: Not more than 0.01%, calculated as phthalic acid.

Water: No turbidity when one volume is mixed with 19 volumes of 60° Bé. gasoline.

Purity: 99% to 100% ester, by weight.

USES

Effective fixative for perfumes and essential oils!

Authorized denaturant for ethyl alcohol!

Excellent plasticizer for cellulose acetate and cellulose nitrate!

Unexcelled solvent for a wide variety of materials!

Properties

Molecular Weight: 222.23

Boiling Point: 296.1°C. at 760 mm. of mercury.

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Melting Point: —40.5°C.

Weight per U. S. Gallon: 9.31 pounds at 68°F.

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NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

51. Ion Exchangers

THE RECENT announcement by Resinous Products & Chemical Co. of four new ion exchange resins was headed by the introduction of Amberlite IRA-400, a highly basic anion exchanger. This resin compares in its basicity with caustic, and matches the acidity of the sulphonic-acid type of cation exchangers. With its relatively high capacity, it makes reverse deionization practical.

Reverse deionization is the term used when the solution to be deionized is passed first through an anion exchanger, then through a cation exchanger. By this means the solution being deionized is held at all times alkaline. The normal procedure, with the cation exchanger first, results in an acid solution between the two separate beds. Thus the ion exchange process may move into applications where the solution must at all times be held alkaline.

The strong basic properties of IRA-400 also indicate its extensive use in treatment of boiler feedwater in cases where complete silica removal is necessary. The resin is strong enough in its action to directly remove slightly ionized silicic acid.

The second new resin is Amberlite IRC-50, a weak cation exchanger of the carboxylic type in which there are no active groups except the carboxylic ones. By buffering action the resin can be converted to a combined salt-acid form to get cation exchange at a controlled pH. This allows separation of closely similar chemicals such as the amino acids. The resin exhibits very high capacity, approaching 100 kilograins per cu. ft. at high pH values.

The other two new resins are Amberlite IR-120 and IR-105. Both are high capacity, sulphonic acid types of cation exchange resins.

52. Fungicide

A NEW turf fungicide called F 531 is being manufactured by E. I. du pont de Nemours & Co., Wilmington. It is said to control copper spot, pink patch and dollarspot which is a turf disease that causes bleached spots of dead grass about the size of a silver dollar. An undiluted, green soluble powder, it is a chromate complex of calcium, zinc, copper and cadmium. Mixed with water, it can be applied as a spray. The manufacturer states that it does not stain, does not corrode the metal in spray equipment, has no odor, and does not harm the grass to which it is applied when used according to directions.

53. Aqueous Colloidal Carbons

CURRENTLY available from Binney & Smith Co., 41 East 42nd St., New York, are a line of collodial aqueous dispersions of carbon black called Aquablaks. Aquablak B is the basic grade since it contains a fine channel carbon in dispersed form which offers the combination of color and strength which is most generally desired. Aquablak H contains a carbon of higher color value for use where the maximum jetness is required. Aquablaks M, R, and S are colloidal dispersions of furnace carbons. All of these are characterized by blue-gray tones and high carbon content. Finally, Aquablak No. 1 provides a dispersion of bone black for use where the high color and flat velvet finish characteristic of this pigment are required.

Whenever a water phase is involved, Aquablaks are recommended. Some better known applications are: leather finishes, wall paper, tire paints, casein paints, natural and synthetic latex compositions, coated papers, viscose rayons, vinyl emulsions, asphalt emulsions, drawing and India inks, shoe polishes, water colors, wood stains, asbestos cement shingles, artificial marble and cement. Their colloidal form eliminates the need for additional grinding or special processing although in certain individual uses the handling may involve some care or precautions not ordinarily required.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

CONTENTS

Ion Exchangers 163
Fungicide 163
Aqueous Colloidal Carbons 163
o-Chlorobenzotrifluoride 163
Injectible Penicillin 163
Zirconium Metal 164
Insulating Varnish 164
Insecticide Base 166
Safety Film 166
Plastic Specialties 168
Pharmaceuticals 168
Adhesive 170
Bakelite Polyethylene 170

54. o-Chlorobenzotrifluoride

PILOT plant quantities of o-chlorobenzotrifluoride (o-chlorotrifluoromethylbenzene) are being manufactured by the Hooker Electrochemical Co., Niagara Falls, N. Y. It is potentially of interest as an intermediate in the preparation of various chemicals and dyestuffs and as a special solvent and dielectric fluid. A colorless, aromatic liquid it is characterized by the CF_3 group. This radical is generally stable to light, heat and chemical reaction. Its distillation range is 150.9 deg. to 152.4 deg. C. Freezing point is —7.4 deg. C.; and its specific gravity at 15.5 deg. C. is 1.379.

55. Injectible Penicillin

A NEW form of injectible penicillin has been approved by the Food and Drug Administration. Wycillin, technically known as crystalline procaine penicillin G for aqueous injection, is a procaine penicillin which may be

PUMPING *Hot Viscous Liquids*

Sulphur

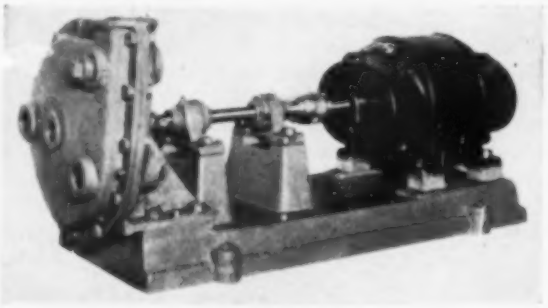
Molasses

Glue

Tar

etc.

Many heavy, viscous liquids can be pumped only at high temperatures. Sulphur, for example, if not kept hot enough, would solidify and clog the system. To meet difficult requirements such as this, Lawrence engineers design steam-jacketed centrifugal pumps for the specific liquid and temperature range involved. Illustrated is a regular side-suction pump entirely enclosed in a steam jacket which also covers the intake and stuffing box. The pump and liquid within are kept at the steam temperature. Write us the details of *your* pumping problem. We'll be glad to discuss it with you — without obligation.



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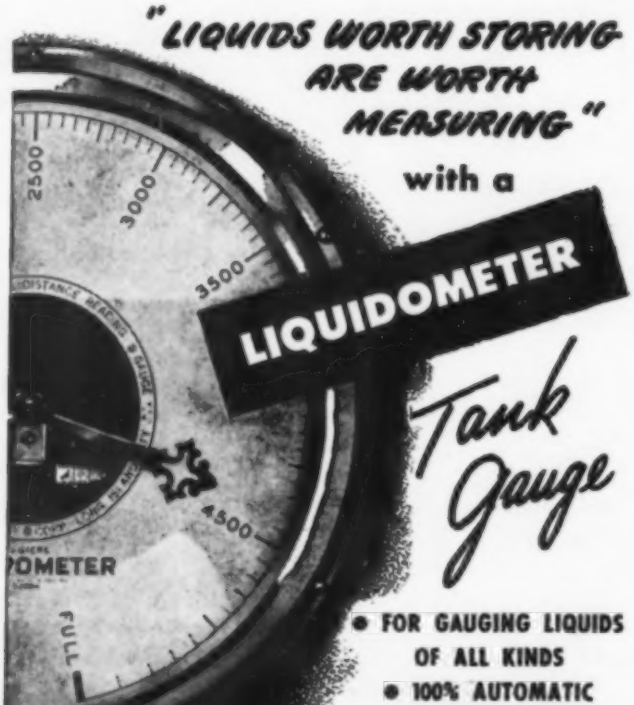
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THE LIQUIDOMETER CORP.

36-29 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

suspended in water. Made by Wyeth, Inc., Philadelphia, Pa., it is said to maintain effective blood levels for 24 hours after injection. It supercedes the sodium salt of penicillin which has to be injected every 3 or 4 hours.

Other forms of penicillin, although they also maintain effective blood levels for a 24-hr. period, are said to be improved upon by Wycillin. It avoids unassimulated lumps sometimes left in a patient by calcium salt of penicillin suspended in peanut oil. It does not cause residual and a few allergenic reactions like the procaine salt suspended in oil.

Reported to be non-toxic, Wycillin does not permit the affected organism to build up a resistance to it. It is the first aqueous preparation of penicillin that doesn't need refrigeration — in water solution it retains its potency for seven days at ordinary temperatures. Cost of the new product, unit for unit, is about the same as ordinary penicillin. About 75-billion units are being placed with 10,000 drug establishments.

56. Zirconium Metal

In the form of bars, sheet and wire, Foote Mineral Co., Philadelphia, Pa., is now manufacturing pure ductile zirconium. Sheet sizes are limited but the manufacturer has developed a process for welding which permits fabrication of liners, tubing and other shapes for chemical equipment. The metal resists nearly all dilute acids and will withstand hot concentrated hydrochloric or nitric acids. Impervious to hot concentrated caustic solution, it should find applications where resistance to both acid and alkali conditions is demanded. Since it sells for about $5 for a piece the size of a postcard, its principal application now is in vacuum tubes where it acts as a gas absorber when red hot. Zirconium, two and one half times as abundant in the earth's crust as copper and 13 times as plentiful as lead, is never found in nature as a metal. Rather it is in the form of a very refractory silicate or oxide. Both defy attempts to free the metal by usual commercial reduction processes.

57. Insulating Varnish

Designated as general purpose varnish No. 9574, a new insulating varnish has been put out by General Electric Co., Pittsfield, Mass. In the deepest coils of winding including enamel, cotton, asbestos and glass-covered wire, it is said to cure to a tough pliable mass. A thermosetting, phenolic drying-oil varnish, it resists

HEYDEN

CHLORINATED BENZENES

MONOCHLOROBENZENE

ORTHODICHLORO-BENZENE

PARADICHLORO-BENZENE

TRICHLOROBENZENE

Heyden chlorinated benzenes (benzols) are widely used in organic syntheses and have extensive applications in the manufacture of solvents, insecticides, textile chemicals, medicinals, weed killers, polishes, explosives, soil and sewage disinfectants, protective coatings, and many other industrial and commercial uses.

AVAILABILITY

Heyden Chlorinated Benzenes are shipped in seller's cars from our plant at Memphis, Tennessee: Tank cars, approx. 74,000 lb.; drums, approx. 475 lb.







ORTHO-DICHLORO-BENZENE

This extremely versatile Heyden chlorinated benzene is in constant demand for the manufacture of petroleum products, metal polishes, soil disinfectants, automotive and industrial solvents . . . for sewage treatment, fumigants, dry cleaners, paints and surface coatings . . . and for wool scouring, gas purification, termite control and leather dyeing.

PROPERTIES

Appearance	Clear, colorless, heavy liquid
Odor	Characteristic, pleasant, aromatic
Boiling Point	180°C.
Freezing Point	−17° to −22°C.
Specific Gravity 25°/25°C.	1.303
Flash Point (closed cup)	160°F.
Solubility	0.01 g./100 g. water at 25°C.; Slightly soluble in alcohol; Miscible with most other organic solvents
Containers	Tank cars, approx. 86,000 lbs.; 55 gal. drums—550 lbs. net

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A set of data sheets describing Circle Ⓛ 22, 22 M and 22 XM, Lebanon's "18 and 8" alloys, is yours for the asking.

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An "18-8" Alloy

NOMINAL ANALYSIS

Carbon Max.	0.07
Silicon	1.25
Manganese	0.75
Chromium	19.50
Nickel	9.00

NOMINAL PHYSICAL PROPERTIES

Tensile Strength	75,000
Yield Point	36,000
Elongation in 2"—%	50
Brinell Hardness	135

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"In The Lebanon Valley"

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON ALLOY AND STEEL **Castings**

CIRCLE L

FOR MORE INFORMATION

See Reader Service Coupon on pages 159-160

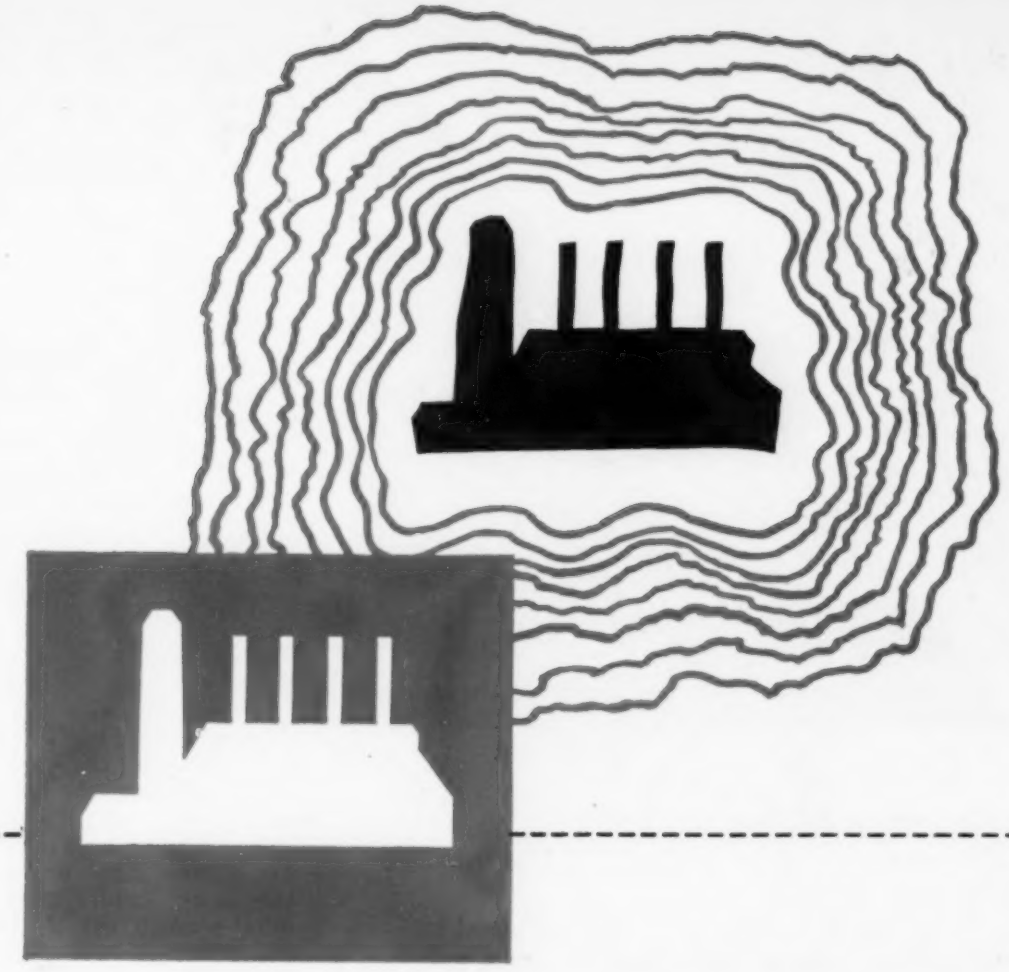
oil, acid, alkali, salt water, moisture, and heat and is suitable for infra red baking. Good build, flexibility, excellent aging properties and the ability to impart dielectric strength are claimed for it. With a flash point of 100 F. and a viscosity at 45 deg. F. of 600 centipose average, it can be cured in conventional equipment at baking cycles as low as 212 deg. F. It can be used at barrel gravity or can be thinned up to 20 percent with petroleum spirits or any other available commercial thinner.

58. Insecticide Base

INCREASED toxicity to insects has been claimed by Eston Chemicals, Inc., 3100 East 26th St., Los Angeles 23, Calif., for their new insecticide base. Called Tetron-100, it replaces their hexaethyl tetraphosphate as a base for making organic phosphate insecticides. It contains 40 percent tetraethyl pyrophosphate and 60 percent other related organic phosphates. Because of the relatively high percent of tetraethyl pyrophosphate, the important active ingredient, the base can be used in very dilute solutions. Usually 50 percent by weight of Tetron-100 is used in a suitable solvent together with an emulsifying and wetting agent. California Agricultural Experiment Station data show the successful control of walnut aphids, cotton aphids and wooly apple aphids, red-spiders and leafhoppers on grapes, and budmites on pears, and great reductions of two-spotted mite infestions on pome fruits with organic phosphate insecticides.

59. Safety Film

A NEW type of film base has been adopted by Eastman Kodak Co., Rochester 4, N. Y. It was early in 1946 that Kodak first replaced acetate propionate safety film support with a new, improved, high acetyl, acetate type. Essentially, the new film is made by retaining chemical acetyl groups which in earlier processes were washed away. Considerable experimental work has been done to test it as a substitute for cellulose nitrate film which is widely used for professional motion-pictures. Safety film generally is slow-



R_x for Plant Palsy*

* *Due to pulsative gas flow*



Fluor Pulsation Dampeners are "tailor-made" to fit every specific requirement.

"Plant Palsy"... vibration due to pulsative flow in gas, air or vapor pipe lines... is an entirely too frequent industrial ailment.

The ideal prescription for this malady is the Fluor Pulsation Dampener. It converts pulsative flow into a smooth, steady stream. It reduces friction losses. It permits stepped-up rate of flow. It increases horsepower efficiency. Pipe line breakage due to excessive vibration, with subsequent danger of explosion and costly shutdown, is largely eliminated. Moreover, accurate meter readings are made possible. The unit has no moving parts; hence no maintenance attention or expense.

If your plant is suffering from "palsy" due to pulsative flow, let Fluor show you the effectiveness of the Fluor Pulsation Dampener... as proved by hundreds of satisfactory installations!

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SERVICES *Designers and Constructors of Refinery, Chemical and Natural Gas Processing Units*

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Looking at a bright new stainless steel vessel, you get no idea whatever about how long it will endure under *your* production conditions.

And yet the way that vessel will "take it" need not be accepted on faith. Go into your fabricator's plant. See if he has all the special equipment and the trained mechanics required to work stainless steel as it *should* be worked; because it's during fabrication that the corrosion resistant qualities of stainless steel are either safeguarded or allowed to deteriorate.

We work exclusively as fabricators of stainless steel. Experience has taught us how to overcome the difficulties that inevitably arise in working with this sensitive alloy. We've equipped our plant and trained our men for this job. The result is more enduring processing equipment for you, built for greater efficiency in your application.

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Guards Alloys in Fabrication

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A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."



CORROSION RESISTANT PROCESSING EQUIPMENT



TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

burning in contrast with nitrate film which burns rapidly. Further advantages claimed for the new film are: low shrinkage, tensile strength, rigidity and flexibility more like nitrate film than earlier safety films, greater resistance to effects of moisture and humidity, projection quality equal to nitrate film.

60. Plastic Specialties

A CORROSION-PROOF pipe and a non-splitting cutting block are being marketed by the United States Rubber Co., Rockefeller Center, New York. Both are fashioned from Kralite, the company's new synthetic rubber-thermoplastic resin blend. It can be molded in any color or shape and in various degrees of hardness. The manufacturer reports that it has excellent resistance to oils and chemicals.

The pipe is made by a continuous extrusion process. No metal or fabric reinforcement goes to its construction. Supplied in rigid and semi-rigid forms, sizes will range from ¼ to 2 in. outside diameter. It may be bent to various radii and threaded for fittings. The cutting block is used on a guillotine-like machine fitted with steel dies to cut shoes, handbags, clothing and other products out of leather, fabric and paper. According to the manufacturer it will not chip or split under the impact of the cutting dies because it has no grain. It is also said to outwear wood and provide a better cutting surface for extremely fine materials such as nylon and rayon fabric.

61. Pharmaceuticals

FOUR new pharmaceuticals have been put on the market by Sharp & Dohme, Philadelphia, Pa. One is a new synthetic analgesic agent, methadon hydrochloride amidone hydrochloride. Said to be superior to morphine, it produces effective analgesia with little or no effect on heart rate or respiration and only a slight drop in blood pressure. In contrast to morphine, there appears to be little or no development of tolerance to the analgesic action of the drug. Reported to be successful in osseous, preoperative and postoperative pain and pain associated with malignant disease, it may also be used for suppression of cough following surgery and cough associated with respiratory diseases. Developed by German chemists during the war, methadon hydrochloride is 2-dimethylamino-4, 4-diphenyl-5-heptanone Hydrochloride.

A second product is Hyotole Sirup. To be used for treating iron deficiency anemia, it contains iron in combina-

FOR

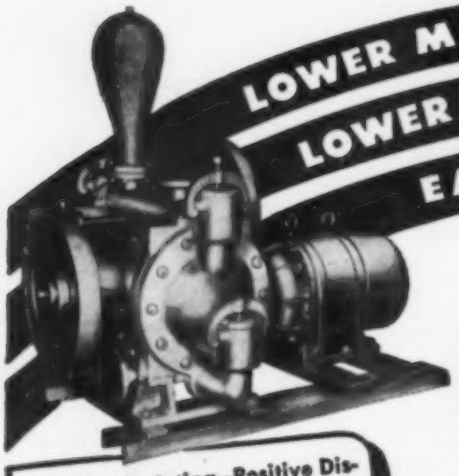
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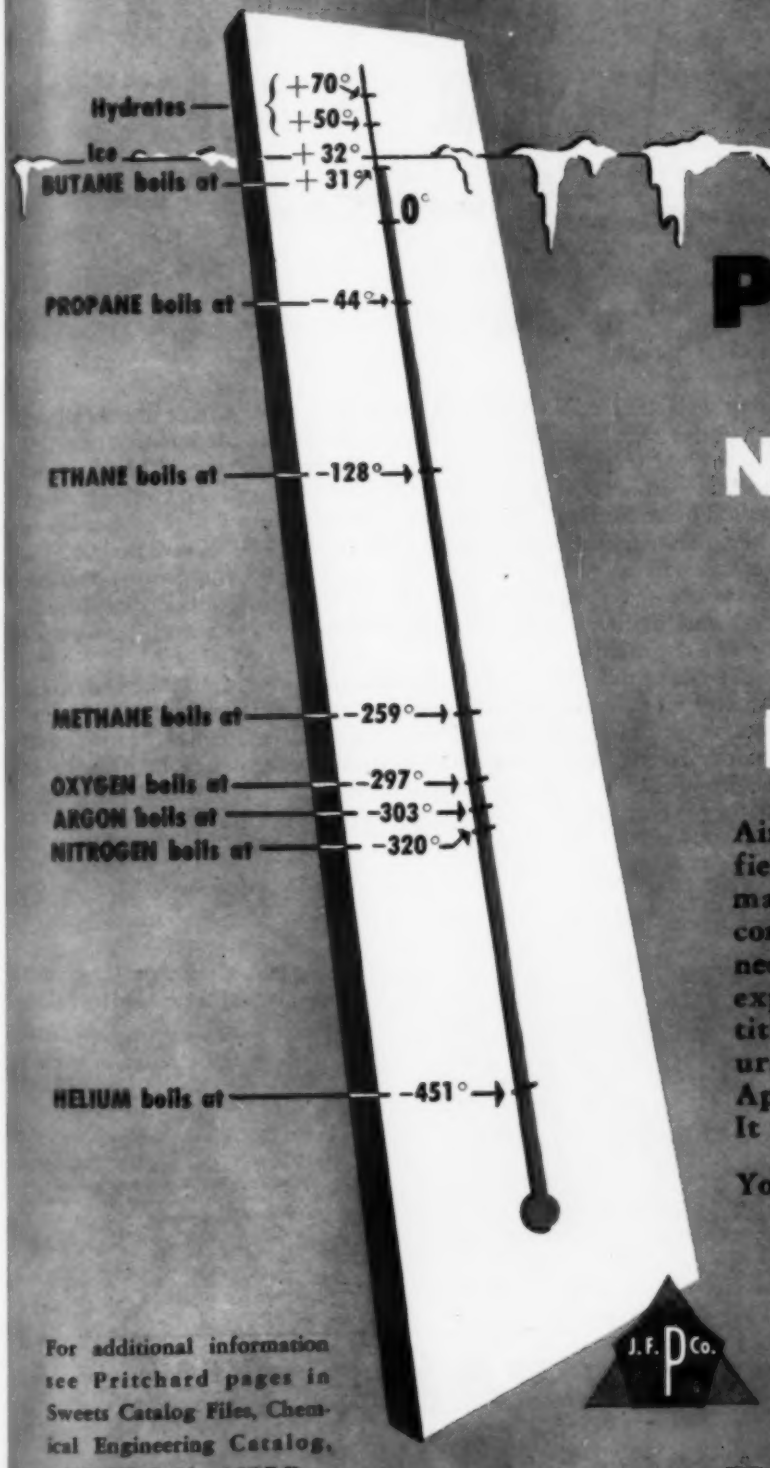
62. Adhesive

CLEAN, efficient operation on all principal types of semi-automatic and automatic labeling equipment is claimed by National Adhesives, 270 Madison Ave., New York, for their new adhesive. Known as Labeltite 405, it is designed to adhere labels on difficult glass surfaces such as opal and oily, wet or hot bottles. It is now available in quantity.

63. Bakelite Polyethylene

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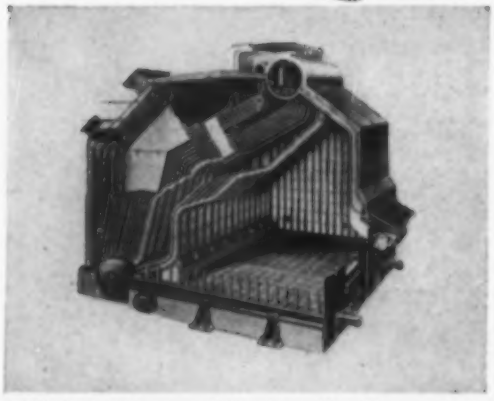
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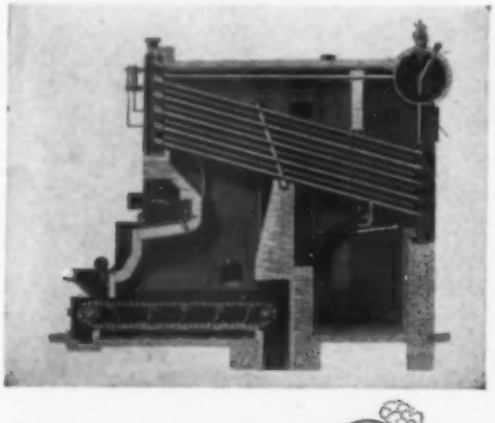


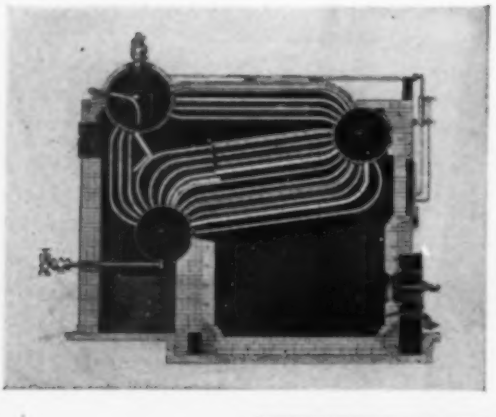
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MEN, MACHINES AND METHODS

Roger Williams, Jr., ASSISTANT EDITOR

Labor Relations Trends

Here is a round-up of the current thinking on labor relations—human relations—a part of the chemical scene of major import.

TRADITIONALLY the chemical industry has thought itself relatively free of labor troubles. And it is, in comparison with the volatile coal mining and automotive industries. But it will come as a shock to some members of the chemical industry to know that in 1947 the industry had 94 strikes, involving 30,800 workers, and that 439,000 man days were lost due to work stoppages. Admittedly the percentage of the estimated working time, as figured by the Department of Labor which supplied all these figures, that was lost by the chemical industry was lower than that for all manufacturing (0.27 vs. 0.43). But the magnitude of the figures justifies some real introspective thought on labor relations.

In considering labor relations, a talk given by L. W. Babcock of the Hercules Powder Co. is revealing. In his talk Mr. Babcock discusses six of the recent trends in the field of labor relations. They are: (1) The spread of the union movement; (2) the development of systematic wage and salary plans; (3) determination of what is on the worker's mind; (4) considerations of security; (5) clarification of economic delusions; and (6) recognition of the importance of the foreman. To this list we would like to add another: (7) A realization of public interest in work stoppages.

Each of these trends cannot be covered in detail, but perhaps it will be valuable to consider each of them at least briefly.

Union Growth

The spread of the union movement is an obvious fact that needs little comment. Perhaps the most interesting development is the tremendous power that unions can wield. The "Guaranty Survey" says, "The almost complete immunity from the anti-trust laws that labor has enjoyed in recent years has permitted the development of labor organizations with a degree of economic power that would never be tolerated in any other group."

Development of systematic wage plans has been slowly moving in two directions. The first is toward tieing wages to the cost of living. This trend was dramatically highlighted in May by the General Motors agreement with the United Auto Workers, where wages will automatically go up or down with the cost of living index. The second trend that is apparent is toward a guaranteed annual wage. Already a few companies have installed such systems.

What Worker Wants

Determination of what is on the worker's mind is a new development, and one that is having surprising results. Babcock puts it, "In many instances job security or congeniality of working associations have scored higher than rate of pay. Also surprising, and perhaps more disturbing, is the discovery that some of the benefit measures most highly valued by management as a means of gaining employee satisfaction have been ignored, discredited or refused." Igleheart, of General Foods, has listed the factors that make up job satisfaction in order: "(1) Interesting work, (2) job security, (3) the interest the company takes in the individual, (4) chances for advancement, (5) working conditions, (6) handling of workers' complaints, (7) — and a rather poor seventh at that—pay, (8) the immediate supervisor, (9) the other people on the job, (10) vacation policy, and (11) working hours." With pay so far down on the list, it seems surprising that so many strikes are called over this issue. It may be that problems higher up on the list are the real trouble and that wage rates are merely the issue that gets talked about most.

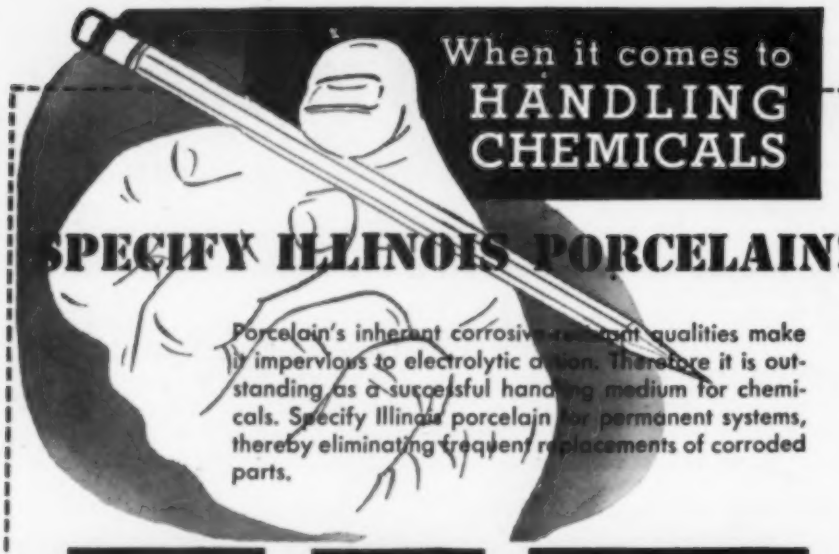
Benefit Plans

The trend toward increased security involves, of course, benefit plans. Babcock summarizes by saying, "There has been increasing awareness that a pressing need for the worker is a greater degree of protection for himself and his dependents against loss of income by reason of sickness, accident, unemployment, retirement or death. It is a sad commentary on our way of life that so many American workers, enjoying the highest average income status the world has ever seen, are so improvident as to rely wholly on outside assistance when regular earnings are even temporarily interrupted."

Benefit plans are definitely on the increase, and are getting increasing attention from unions. Witness the mine workers and auto workers on pensions. The over-all list of types of benefit plans operating in industry is long. It includes such forms of insurance as life, accident and health, hospital, and surgical. Other items are disability wages, lay-off payments, and pensions. With pensions the leader in the movement toward more benefit plans, it is surprising that only 3,290,000 workers were covered by such plans in 1946. That means less than 10 percent.

There are dangers in the introduction of benefit plans. Babcock points out two: "First, a plan must be fiscally and actuarially sound, so that it doesn't present the risk of discontinuation during 'hard times' when it may be most needed. Secondly, benefit provisions should not edge over into the area of paternalism, an effect that would be resented by union representation, distasteful to the employees and perhaps destructive of the improvement in morale that is a secondary objective."

The fact that the United States worker is suffering from economic delusions about free enterprise and his job has long been known. The



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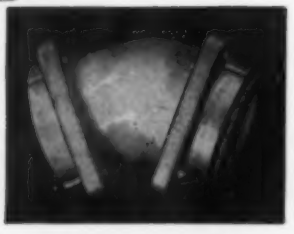
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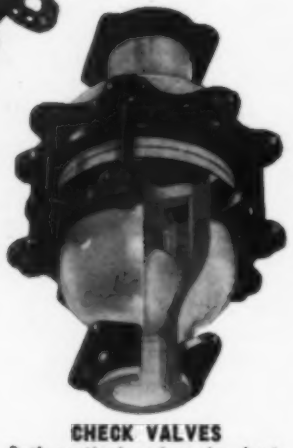


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thing that has happened recently is that management has finally awakened to the fact that something should be done about it. Babcock lists some of these delusions, "process improvements cause fewer jobs, wages should be tied to profits, increased wages always mean better standards of living, profits are too large, executives are paid too much, workers can produce less and get more, outside leadership is interested in the employee but the company is not, the rich are getting richer and the poor, poorer, 'waste and waste, spend and spend, and let the company take care of our every need.' "

The Challenge

Igleheart calls this economic delusion "A Challenge to American Management." Let's listen to what he has to say: "Yes, we are tops, technologically. We have given tremendous demonstrations of economic strength. And yet, when we discuss the very virtues of our system, we feel we have to defend it. Why? The fact is we are on the defensive. The fact is, we are operating in an atmosphere that is partially hostile and largely indifferent to our own aims and views. Consider the public opinion polls. Perhaps they aren't perfect 'cat's whiskers.' They can err in judging elections when a small percentage may tell the tale. But they can evaluate clean-cut trends with satisfactory accuracy. And this is what the Opinion Research Corp. tells us: *Twenty-four percent of the American people as a whole lean definitely toward some drastic, fundamental change in our social, political, and economic system. . .* That, to me, is a greater challenge and a better incentive to action than our old friend, 'The Red Menace,' or his new cousin, 'The Cold War.' Here stands our great economic machine capable of pouring out production and wealth that can help to raise world living standards and assure world peace. But if somebody smashed the 'generator'—freedom of economic choice—or cuts off the 'fuels'—competition and profit—what then of our liberties? What then of our living standards? What then, for that matter, of management itself?"

Igleheart concludes, "There is the challenge! Speaking bluntly, a petition in receivership has already been levelled against American management by a substantial minority of our people. Will the hearing find us bankrupt in the qualities of leadership? I think not. . . . I am sure that if we act with decision and speed, we will find the path to understanding, freedom, cooperation, and peace."

Recognition of the importance of

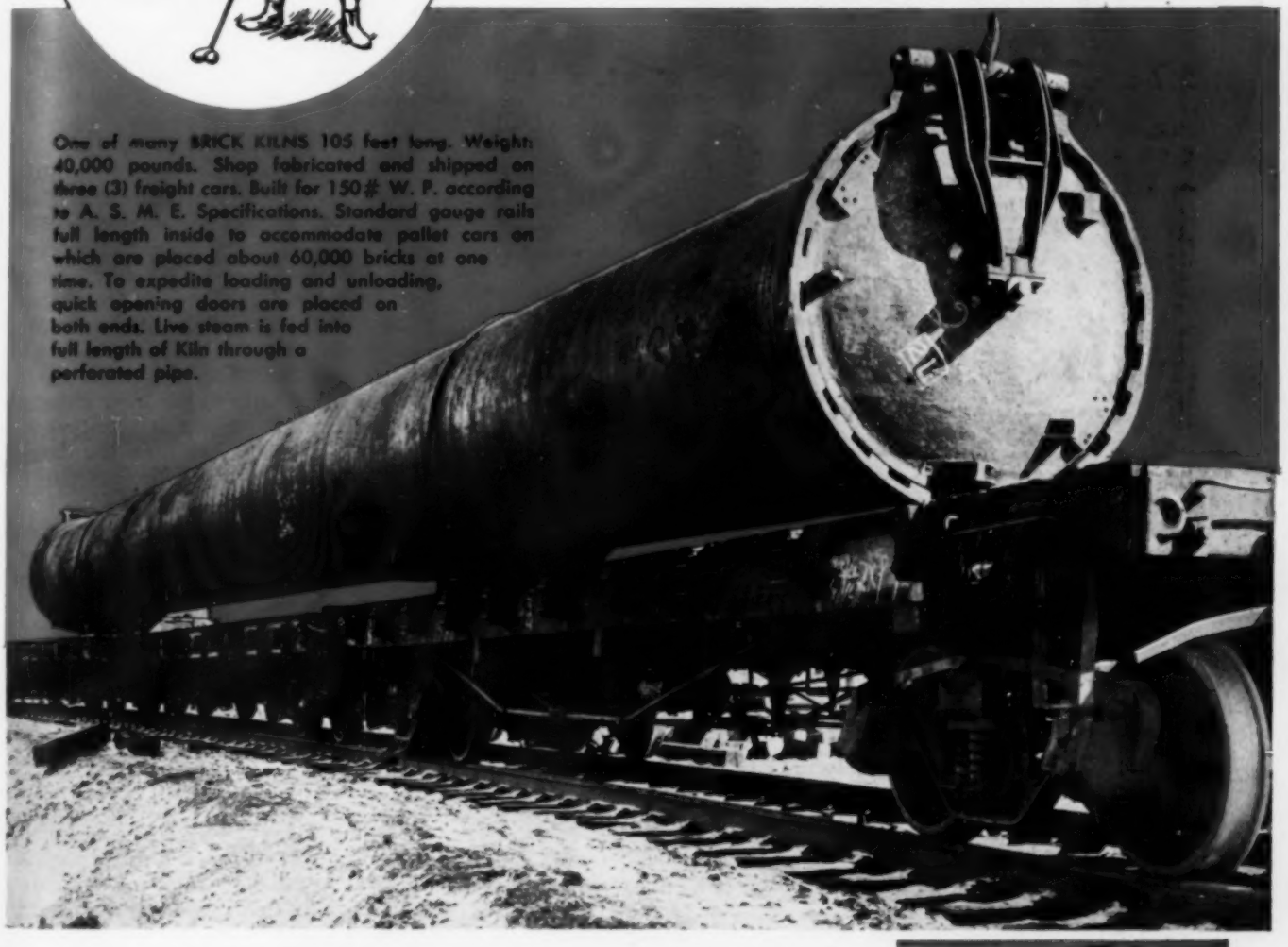
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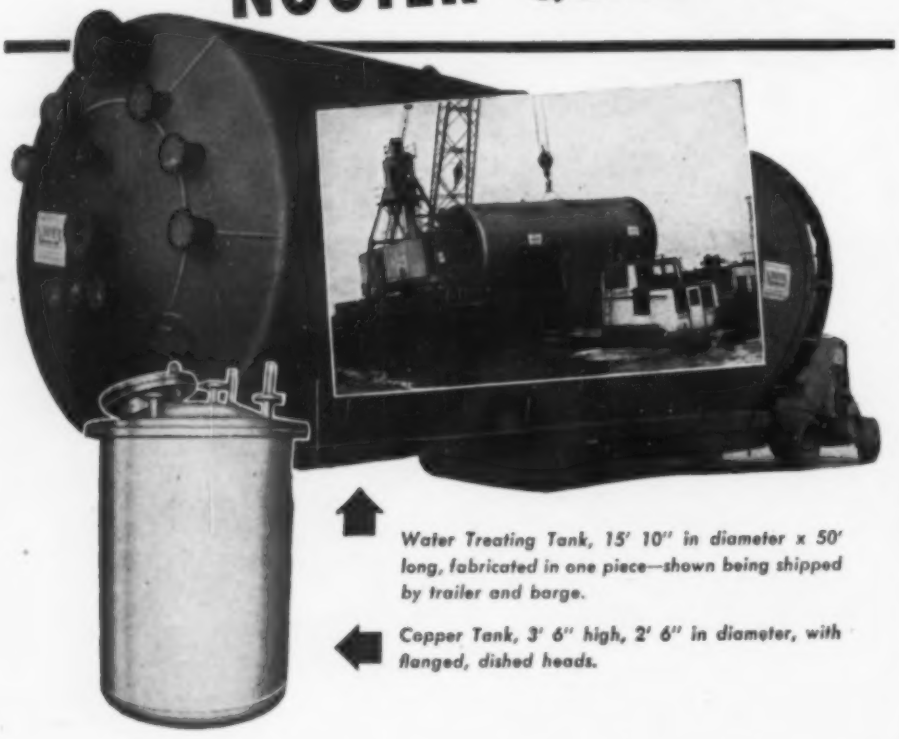




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the foreman is another recent trend, which probably came to management when foremen began to drift toward unionization. As Babcock puts it, "There has dawned upon industrial leadership the realization that immediate supervision—the foreman and direct supervisor—is a part of management and that on this group rests the fate of any labor relations program. . . (The foreman) is coming into his own—and it is high time." The problem is not to define which side, labor or management, the foreman belongs on. Most people will agree readily that he is management, and one of the most important parts of it. The question is how management can make the foreman realize that he is part of management. Again it is a problem of imparting information, clearly, convincingly.

Public Interest

We have added a seventh to Babcock's list of six recent trends in labor relations. It is a growing realization of the part played by public interest in industrial disputes. Public utility, railroad, and coal strikes (or threats of them) have brought home the fact that a work stoppage in such industries can affect the public more than either party to the labor dispute. What has brought this situation to its present stage has been the development of industry-wide bargaining. The odd part of industry-wide bargaining is the fact that it robs labor of one of the best strike weapons it has. A strike against one manufacturer, while not against another, makes the struck management want to settle the strike as soon as possible. Otherwise business may be permanently lost to the non-struck company.

But industry-wide bargaining seems to be growing. So, too, is the tendency for nation-wide wage patterns to be set by the action of one unit of industry. For example, the Big Steel wage boost in 1946 set a national pattern. It is yet to be seen whether the General Motors wage settlement will have the same end result. Oddly, this tendency toward national wage patterns is a step toward something managements dread: governmental control of wages.

Such, then, are some of the trends influencing labor relations today. Whether these trends will continue, change or decline is hard to predict. But they are worth thought by both management and labor—and by every employer and employee. All of us are affected daily by some form of labor relations, because in the final analysis labor relations is human relations.

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CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR



BEFORE—Modernization at Champion included smoke abatement—AFTER

New Equipment Installed in Paper Company Expansion

IN ADDITION TO its smoke abatement program (*above*), Champion Paper and Fibre Co. plans to install several fourdrinier machines in its pulp and paper plant at Pasadena, Tex., near Houston, in the course of an expansion program designed to make the plant a fully integrated paper mill. In addition the company recently purchased 344 acres of land near Silsbee in east Texas. That Champion plans to build a new plant on the tract has been rumored, but so far has not been confirmed by the company.

One of the three fourdriniers to be installed will be a machine-coat unit for producing magazine paper; a second will manufacture offset, bonds and coffee bag papers; and the third will produce some offset papers and some uncoated groundwood book papers. These machines will be erected in a new section of the plant where a cylinder machine brought from the company's Hamilton, Ohio, mill last year has been making food container board.

At the tenth anniversary celebration of the Pasadena plant in June the company revealed that the plant has been producing as a daily average 400 tons of chemical (sulphate) wood pulp and about 35 tons of groundwood pulp. Pine logs and tops from east Texas constitute the major supply of raw material. Of the 400 tons of chemical pulp, about 150 goes into finished magazine and food container stock manufactured at Pasadena; the remaining 250 is shipped elsewhere to Champion and other paper mills for conversion into book paper.

California Standard Starts Wax Refining Unit

PAY-OFF on $3,500,000 worth of wax plant being erected by Standard Oil Co. of California at Richmond will begin with its completion this November. Rated annual capacity will be 4,500,000 lb. of product. The $7,000,000 grease plant and warehouse, long in coming, will be finished at the same time.

Three basic steps are involved in the wax refining. Crude wax with an oil content of about 20 percent passes through a distillation unit at a rate of approximately 1,700 bbl. daily. Deoiling and stripping are accomplished in an adjoining three-story building. After any color pigment or foreign matter has been removed in the filter plant, wax is shaped into 10-lb. slabs and packaged for shipment.

A number of refined waxes melting at 125-165 deg. F. will be turned out. Markets and uses: waxed paper for wrapping bread, fruit, vegetables and other food products; paper coatings for milk cartons; and base stocks for medical and dental products and cosmetics.

Plant Seizure Legal Under New Law

INDUSTRIAL control as well as military manpower are provided in the Selective Service Act of 1948. Generally overlooked has been one vital provision for "utilization of industry."

This section of Public Law 759 starts out with provisions intended to favor small business in getting military orders. But its most important parts for industry generally are those which provide that industry must accept orders or that industrial establishments not accepting them may be seized by the government.

Such action by the President may be taken when a firm declines to take an order, declines to give precedence to such orders, declines to produce the kind or quality of goods desired, or declines to fill such orders within a prescribed time. Mild and very general provisions restrict the President in exercising this authority through any government agency; but dictatorial action is possible. The provision for "fair and just compensation" is also very limited in prospective protection for industrial establishments.

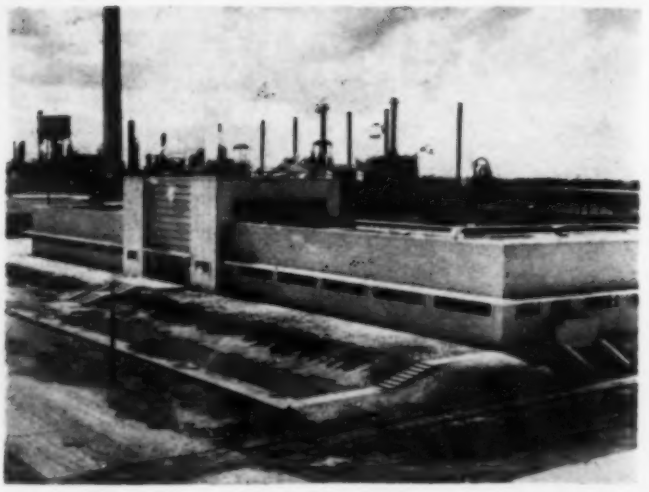
In general it appears that the provisions of this brief portion of the new law are quite as sweeping as any war powers previously held by the President during periods of active warfare.

Another Fertilizer Unit For Mississippi

A FERTILIZER plant is being built near New Albany, Miss., for the Southern Belle Fertilizer and Chemical Co. Nominal annual capacity is 55,000 tons of mixed fertilizer and 30,000 tons of superphosphate. The mixing plant probably will be in operation by next spring. The superphosphate plant will go into operation later.



Goodrich in Ohio



Shell in Texas

Goodrich Opens Research Center at Brecksville

NEW FACILITIES which will "make it possible to bring scientific discoveries to maturity three or four times faster than at present" were inaugurated at Brecksville, Ohio, recently. The new B. F. Goodrich Co. multimillion dollar research center is equipped with all the latest scientific tools and equipment. At the opening ceremonies, John L. Collyer, president of the company, said that "The center is, we believe, the most complete industrial workshop of science now in existence." The center will carry out extensive research on natural and synthetic rubber, chemicals, plastics, agriculture, horticulture, and the application of nuclear energy to rubber manufacturing.

The main building is a three story structure which contains no windows except at ends of hallways. It is 226 ft. wide, 172 ft. deep, contains 81 individual laboratories, a cafeteria, assembly hall seating 250, and a 10,000-volume library.

Chicago Chemical Show Will Have Technical Bureau

THE NEWLY created Technical Bureau at the National Chemical Exposition, Chicago Coliseum on October 12-16, 1948, will be a personal information service available to all who are in attendance at the international Exposition, according to Dr. Clifcorn, chairman of the Exposition Committee, Chicago Section, ACS.

The technical bureau will be manned between 3 and 6 p.m. daily by Dr. Ward V. Evans, retired chairman of the chemistry department of Northwestern University, now professor of chemistry, Loyola University.

Dr. Clifcorn pointed out that Dr. Evans is eminently qualified to give helpful, over-the-counter information to business men and manufacturers seeking knowledge of how the chemical industry can help them with their problems. He will also supply directions to the proper place on the exposition floor for other desired information.

Many specific problems, both on product development and production, are brought to the exposition. It is intended that the technical bureau personal service will aid in developing solutions to these problems.

ACS National Meeting Will Be Held in Three Cities

THE 114th national meeting of the American Chemical Society will be held in three sessions in Washington, D. C.; St. Louis, Mo.; and Portland, Ore.; August 30 to September 17, says Dr. Charles Allen Thomas, president of the society.

The Washington session will run from August 30 to September 3; the St. Louis session from September 6 to 10, and the Portland session from September 13 to 17.

The divided national meeting, first in the society's 72-year history was arranged to enable the maximum number of the 57,000 members to attend, according to Dr. Thomas, who is executive vice president and technical director of the Monsanto Chemical Co., St. Louis.

Recent developments in virtually every field of chemical science and technology will be reported in several hundred papers at a total of 120 technical sessions to be held in the three cities, under the sponsorship of 18 professional divisions of the society. One hundred and twenty-seven local sections will be represented.

Shell Completes Its Houston Refinery Laboratory

SHELL OIL CO. last month completed in its Houston refinery a $1-million laboratory which will centralize all routine control testing formerly done at scattered points in the plant. In addition, the completely air conditioned structure contains offices and laboratories for technologists who are engaged in experimental and development work. A subsidiary building houses a knock-test laboratory, where the anti-knock characteristics of gasolines and diesel fuels are determined.

The main building has an analytical-experimental section. This group handles analytical work, does trouble-shooting for the plant, performs bench pilot plant operations and carries on development studies in connection with byproducts. Another section, the effluent control department, makes routine control tests on effluents from the plant in order to guard against pollution and reduce losses of petroleum oils.

The Austin Engineering Co. designed the building and the Knutson Construction Co. of Houston erected it. It is a brick on steel frame structure with tiled outer walls.

Chemical Engineers Needed For Government Service

ANNOUNCEMENT of positions for all branches of engineering was expected in mid-August. A Civil Service register of P-1 engineers is to be created on the basis of an unassembled examination, open until further notice.

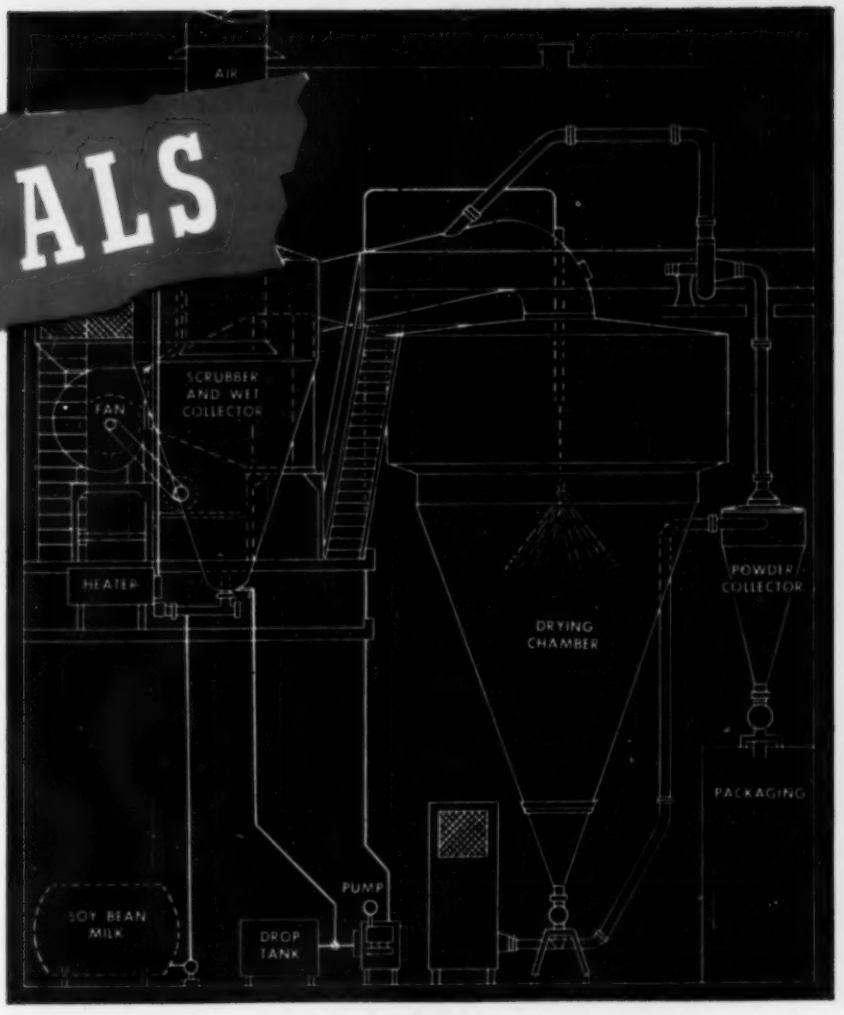
Requirements are a successful completion of a four-year professional engineering curriculum, or four years of professional experience equivalent to college training, or some equivalent

CHEMICALS

can be processed with

SWENSON GRAY-JENSEN

Spray Dryers

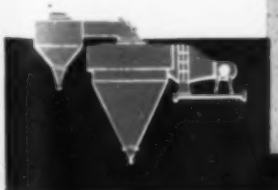


The versatility of the Swenson Gray-Jensen Process of spray drying permits innumerable adaptations. Plant layout and equipment are designed to provide drying temperatures and conditions compatible with the nature of the product, and at the same time to afford over-all economy of operations.

The Swenson Process has many important advantages over other drying methods:

- Material is converted from liquid to powder in a single pass.
- Low product temperature—particle temperature need rise only slightly above wet-bulb temperature of the gas, thus avoiding injury to heat-sensitive materials.
- High temperature, high capacity production—practical and economical for handling materials of non-heat-sensitive nature.
- All welded alloy construction for parts in contact with liquid, vapor, or solids.
- Drying may be accomplished in multiple stages, giving full control of moisture content of the finished product.
- Solids are totally recovered—there is no loss, and no problem of dust in the plant or neighborhood.

Full plant-scale test runs may be arranged quickly at the Swenson Spray Dryer Research Laboratory at reasonable cost. This is good insurance! If you have a product which can benefit from the advantages of spray drying, write at once for information.



SWENSON EVAPORATOR CO.
DIVISION OF WHITING CORPORATION
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Inter-batch uniformity

. . . a vital step in manufacturing RAYON

Flattering hosiery from thermoplastic chips . . . a manufacture requiring a uniformly mixed product. Towering 360 cu. ft. mixers fulfill this exacting need by continuously blending individual mixes into one homogeneous stock.



Sprout-Waldron Vertical Mixers Offer:

- minimum floor space
- low power consumption
- inter-batch reservoir

From glue flakes to organic dyestuffs . . . Sprout-Waldron vertical blenders are proving their worth in widely diversified industries. Capacities range from 10 to 375 cu. ft. Construction features and materials meet individual installation requirements . . . from stainless steel to Plexiglas.

If you mix, reduce, separate, or handle material in bulk, consult Sprout-Waldron. Our valuable ADAPTIONEERING service — ingenuity + machines + experience — is at your command.

SPROUT WALDRON
Manufacturing Engineers

combination. Age limits are 18 to 35 except for applicants having veterans' preference.

Positions available are in Washington, D. C., nearby Maryland and Virginia. The starting salary is $2,974. Applications will be accepted from students who expect to complete their courses within six months of the date of filing their application. For further information address U. S. Civil Service Commission, Washington 25, D. C., or its regional offices.

Fertilizer Output Starts In New Tulsa Plant

Missouri Chemical Co. has begun the manufacture of mixed fertilizers and superphosphate in a new $500,000

CONVENTION CALENDAR

American Chemical Society, 114th national meeting, Eastern session, Washington, August 30-September 3.

American Society for Engineering Education, third summer school for chemical engineering teachers, University of Wisconsin, Madison, Wis., August 30-September 4.

American Chemical Society, 114th national meeting, Midwest session, St. Louis, Mo., Sept. 6-10.

American Chemical Society, 114th national meeting, Western session, Portland, Ore., Sept. 13-17.

American Association for the Advancement of Science, centennial meeting, Washington, September 13-17.

American Institute of Chemical Engineers, regional meeting, French Lick Springs, September 15-17.

Third Instrument Conference and Exhibit, Convention Hall, Philadelphia, September 13-17.

National Plastics Exposition, Grand Central Palace, New York, September 27-October 1.

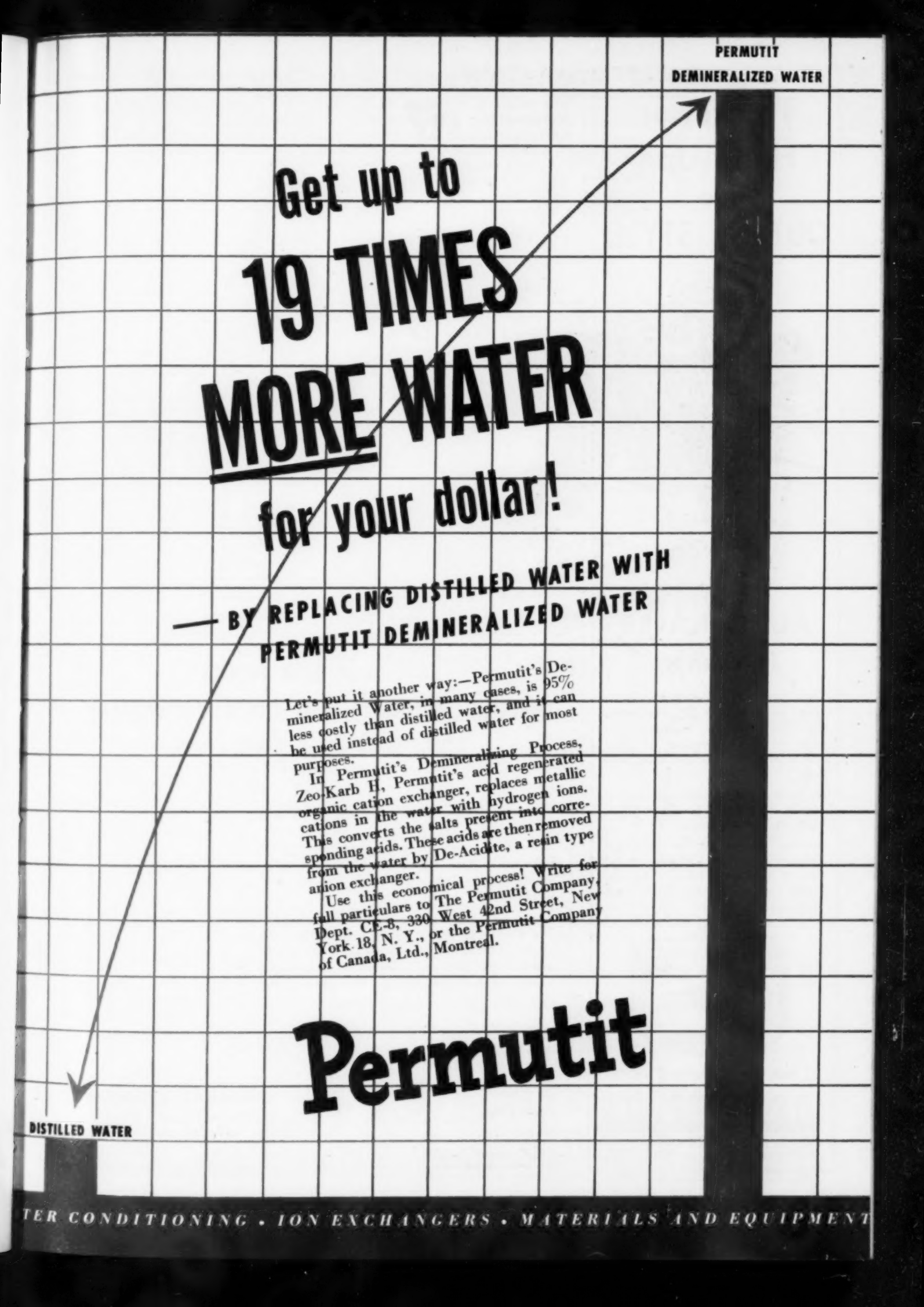
Fifth National Chemical Exposition, Coliseum, Chicago, Ill., October 12-16.

Association of Consulting Chemists and Chemical Engineers, annual meeting, Hotel Sheraton, New York, Oct. 26.

National Paint, Varnish, and Lacquer Association, Congress Hotel, Chicago, Ill., Nov. 8-10.

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, Ill., November 8-11.

American Oil Chemists Society, fall meeting, Pennsylvania Hotel, New York, N. Y., November 15-18.



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Let's put it another way:—Permutit's Demineralized Water, in many cases, is 95% less costly than distilled water, and it can be used instead of distilled water for most purposes.

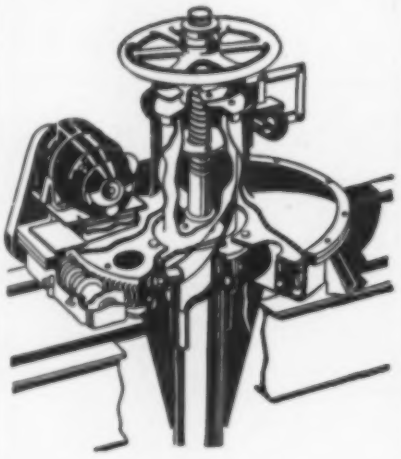
In Permutit's Demineralizing Process, Zeo-Karb H, Permutit's acid regenerated organic cation exchanger, replaces metallic cations in the water with hydrogen ions. This converts the salts present into corresponding acids. These acids are then removed from the water by De-Acidite, a resin type anion exchanger.

Use this economical process! Write for full particulars to The Permutit Company, Dept. CE-8, 330 West 42nd Street, New York 18, N. Y., or the Permutit Company of Canada, Ltd., Montreal.

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Thickener "Hang-Ups" are OUT OF STYLE

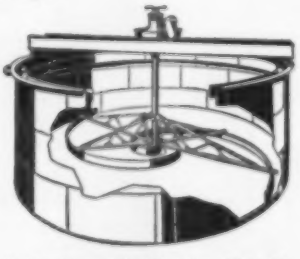


. . . with Hardinge "AUTO-RAISE" Thickeners

The ingenious mechanism shown above automatically lifts the entire thickener scraping assembly upward when an overload of pulp occurs anywhere in the tank bottom.

Restarting after power failure will not cause scraper breakage when "Auto-Raise" is at work.

Another feature of the Hardinge Thickener is the double spiral scraper (shown below) which removes solids rapidly — prevents "pile-ups."



Ask for Bulletin 31-D

HARDINGE COMPANY INCORPORATED

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plant at Tulsa, Okla. Capacity is about 150,000 tons per yr. The company buys sulphuric acid from the Ozark Mahoning Co., Tulsa, and obtains other materials used in the production of superphosphate and mixed fertilizers from various localities. The company also operates a similar plant at Joplin, Mo.

Texas Research Group Changes Its Name

TEXAS STATE RESEARCH FOUNDATION, Renner, Tex., has changed its name, and is now known as the Texas Research Foundation. In explaining the change Dr. C. L. Lundell, director, says the shorter name will eliminate a cause of confusion, since the foundation is not a state institution and does not receive tax support. The operating budget of the foundation this year is over $200,000.

More Solid Nitrogen Asked by Grange

IN A FORMAL letter of inquiry to National Fertilizer Association, Master of the National Grange, Albert S. Goss, urged on the industry steps to supply larger quantities of solid nitrogen carriers for use of farmers, especially in the southeastern states. A mild protest was made that farmers are now encouraged, almost forced, to buy mixed fertilizer in order to get wanted quantities of nitrogen carriers.

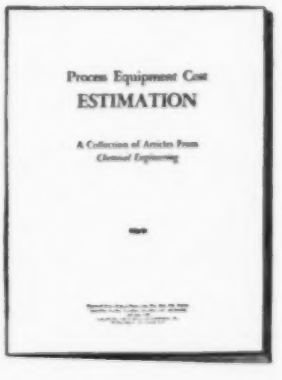
Reply for the fertilizer industry from President Maurice H. Lockwood emphasized two facts. First, in almost every part of the United States the total nitrogen consumption has been steadily increasing. Thus no serious shortage of this important plant food for crops has been experienced. Second, much of the nitrogen supplied in mixed fertilizer could not be used for separate direct application as it is in form of solution or as anhydrous ammonia for which distribution equipment and methods are not generally available.

Facts presented by Lockwood indicate: About 40 percent of the total nitrogen used in fertilizer was sold as solid, containing 340 thousand tons of nitrogen. Balance used as mixed fertilizer included 510 thousand tons of nitrogen, of which slightly over half came from anhydrous and solutions.

Almost simultaneously Food and Agriculture Organization of the United Nations was summarizing the world facts. It pointed out that production of nitrogen for fertilizer during the next fiscal year, 1948-1949, is

SAVE TIME AND MONEY THROUGH ACCURATE AND QUICK PRELIMINARY EQUIPMENT COST ESTIMATION

This 80 page booklet entitled "Process Equipment Cost Estimation" will help process engineers arrive at quick preliminary estimates necessary in every project. The thirty articles it contains will lay the groundwork for final estimates and serve as a check on them.



The articles are of three kinds: introductory, including equipment cost indexes; costs of specific kinds of equipment and buildings; and costs as percentages of total plant costs, and in comparison with each other.

Every process engineer as well as every plant should have a copy of this valuable booklet. The price is only $1.00.

WRITE TO EDITORIAL DEPT.

Chemical Engineering
330 West 42nd Street
New York 18, New York

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. . . but couldn't you get BETTER if you used more Stainless Steel?

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To obtain better yields, greater speed, and lower operating costs, the chemical process industries in recent years have been forced to employ higher and higher temperatures and pressures. This has usually involved more severe corrosion conditions. As a result a more extensive use of Stainless Steel has become imperative. In fact many of today's high-speed operations would be impossible or uneconomical without it.

Where corrosion-resisting construction is essential—where product contamination must be avoided—where down-time for repairs and replacement must be kept to a minimum, nothing equals Stainless Steel.

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In U·S·S Stainless Steel we offer you a *complete* family of perfected, special-purpose steels—available in a variety of analyses that will meet almost any service requirement. Our engineers are specialists in its uses and will gladly assist you in selecting the *proper* type to ensure you the optimum benefits from its application. Write for their assistance, outlining the problems you have in mind, to United States Steel, 2026 Carnegie Building, Pittsburgh 30, Pa.

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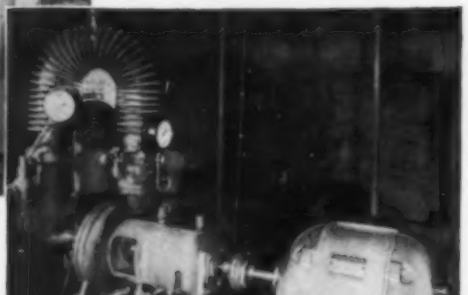


Drying Rolls of the 78-in. Paper Machine

"Our Cochrane C-B System repaid its cost in less than a year", says Norristown Magnesia and Asbestos Co.



Cabinet Dryers for Corrugated Papers



This is the Cochrane C-B unit used with the steam system at Norristown Magnesia and Asbestos Company.

An Industrial "Must"

WHEN engineering skill and manufacturing "know how" team up to provide an industrial "must"—you can't afford to be without it. That's the story of Cochrane C-B . . . the "closed circuit" system of steam condensate return.

Whenever steam flashes off in returning to the boiler, heat units wash down the drain. *They're wasted!* That means more fuel needed to replace them . . . it means lower temperatures in the steam system . . . it means increased makeup treatment cost . . . That's why we say Cochrane C-B is "an industrial must".

It's a "closed circuit" high pressure condensate return system. There's no flashing of steam. Condensate is pumped back to the boiler at the highest possible temperatures. Positive removal of condensate and insulating entrained air is insured. Uniform temperatures boost production and save fuel.

F. T. Cleveland of the Norristown Magnesia and Asbestos Company, Norristown, Pa. says, "This system has repaid its cost several times over during the past year in production increases. It affords better quality of paper because of high and uniform heat transfer rates and there are definite fuel savings from the return of condensate at higher temperatures".

Cochrane C-B is installed on almost 100 corrugators throughout the country. Write today for detailed information.

COCHRANE CORPORATION
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COCHRANE C-B CONDENSATE BOOSTER SYSTEM

OF HIGH PRESSURE, HIGH TEMPERATURE CONDENSATE RETURN

expected to be about 11 percent greater than the year which closed on June 30. Its enthusiasm also includes the statement, "and somewhat greater increases are anticipated in each of the succeeding years." The policy decisions, determining distribution to all countries of all fertilizer chemicals, continue under FAO as neither nitrogen, phosphate, nor potash are in adequate supply, considered on a world-wide base.

President Truman Calls Safety Conference

A NATIONAL conference on industrial safety will be held in Washington September 21 to 23 inclusive on call of President Truman. Active direction will be under Bureau of Labor Standards with Director William L. Connolly presiding as chief executive. Chemical process industries will be represented through Manufacturing Chemists Association which has a member on the Safety Advisory Committee of the Bureau. Program details are still in the making.

Brown Instrument Announces Expansion Plan

A $2.5 million expansion program has been announced by Brown Instrument Co., Philadelphia. It will add more than 60 percent to its present manufacturing space and a proportionate increase in employment, said Henry F. Dever, president. The program includes construction of a four-story addition to the main plant at Wayne Junction. Building began in May and the first phase of the project is scheduled for completion next March. The foundation and footings of the new wing are designed so that four additional floors may be added at a later date.

New Petrochemical Firm Erecting Texas Plant

A NEW organization, Stanton Chemicals, Inc., has moved into the field of petrochemicals manufacturing and is well advanced in the construction of a plant in the vicinity of Corpus Christi, Tex. Initial production is scheduled to begin late this year.

Robert E. Stanton, the president, says that the nominal capacity of facilities under construction will be 50 tons of finished products per day. Plans have been made to raise this figure to about 200 tons during the first year of operation. A large proportion of the output will consist of aromatic hydrocarbons and their derivatives, in-

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Through expanding production facilities at the **CHEMCEL** plant, at Bishop, Texas, Celanese is making available increased quantities of organic chemicals vital to industry.

Formaldehyde, one of the most important products in the growing family of Celanese* Organic Chemicals, is now offered in greater volume. This high quality, U.S.P. chemical is sold commercially as Formalin, a water white solution containing 40% formaldehyde by volume, 37% by weight. It is obtainable in both methanol inhibited and uninhibited grades.

A clear, colorless liquid, controlled to meet exacting requirements, Celanese Formaldehyde is widely used in resins, adhesives and plastics, and in the production of various organic chemicals.

A brochure is available containing specifications and general information on many of the Celanese organic chemicals. Write for your copy—and call Celanese whenever you need technical assistance regarding organics.

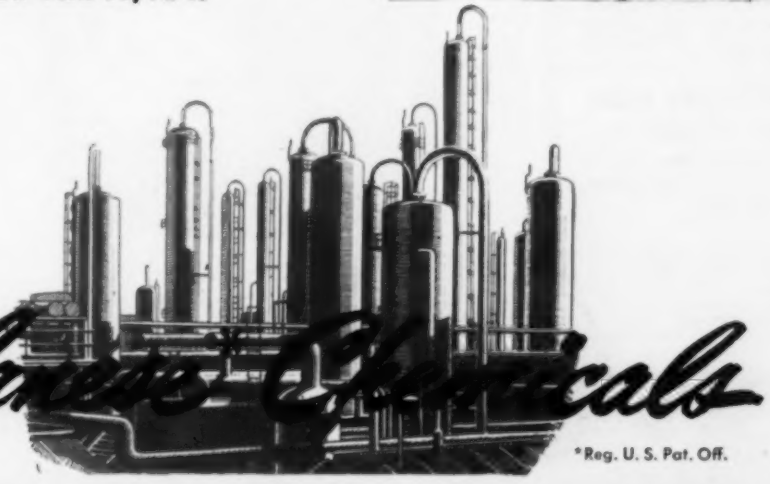
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CELANESE* ORGANIC CHEMICALS NOW IN PRODUCTION:

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tells you Where to use . . . How to use . . . and How to Select Industrial Protective Equipment

• This **NEW** CESCO Catalog is "industry's guide to accident reduction." That's what safety men who have seen it say. It completely explains and illustrates how to buy and how to use industrial protective equipment. All technical information is based on reports from impartial experts. Much of it applies to all protective equipment, regardless of make.

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cluding benzene, toluene, xylene, naphthalene and phthalic anhydride. Halogenated, nitrated and oxidized compounds may also be manufactured.

Features of the plant include special conversion processes and catalytic equipment developed by the company's research research and engineering staff.

Stanton, a consulting engineer of Denver, Colo., has been identified with the development and installation of various projects in the oil refining and petrochemicals field in the Rocky Mountain and Mid Continent regions. During the war he was engaged in advisory work in connection with several federal agencies concerned with the production of synthetic rubber, organic chemicals and special motor fuels.

Propane Deasphalting Plant Under Construction in Utah

PRELIMINARY construction work is already under way on a $2,500,000 propane deasphalting plant of Utah Oil Refining Co. at North Salt Lake City. The expansion will supplement high-octane refining facilities purchased from WAA. Operation by the first quarter of next year is expected.

Feed stock for the new plant will be crude residuum. Processed with liquid propane, it will be separated into asphalt and feed stock for the catalytic cracking units. Refinery crude capacity will be increased to 25,000 bbl. daily. Catalytic cracking capacity will also be increased because of improvements in gas-oil feed stocks. Decision to use propane deasphalting, according to president E. S. Holt, was made after a thorough study of commercial methods of processing crude residuums. Refinery superintendent is Frank R. Clark. A. W. Neeley is director of research.

New Enterprise Gets Some Tax Exemption

PUERTO RICO is now actively applying certain novel tax-exemption rules for new enterprise, especially for manufacturing establishments. Under a new law enacted this summer the Puerto Rican government has set up a list of some 40 kinds of industries for which exemption is given from both income tax and property tax for a period running until 1959, or occasionally to 1962. Included in the list of types of business to be so encouraged are a number of divisions of chemical process industry including: ceramics, glassware, pottery, soap, paint, edible fats and oils, leather

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Capacities:
10 to 1000 gallons

Made of
Stainless steel
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ESCO special control valves can be equipped to operate by electric motors, hydraulic or air pressure.

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Please give us further information on ESCO special control valves.

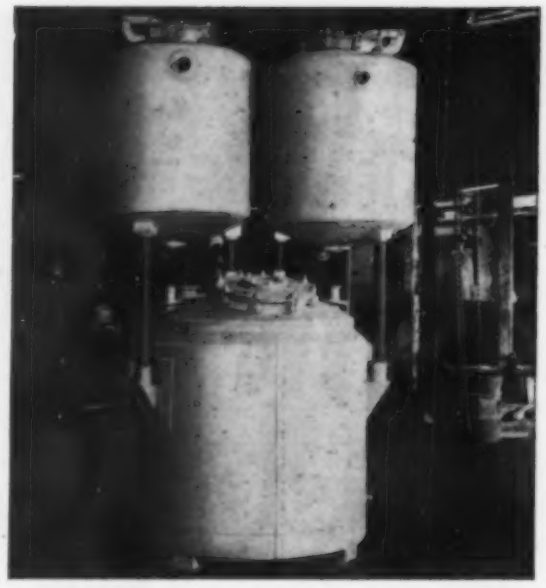
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Before new products and new processes can be turned into profitable realities, there is frequently need for vessels and processing units which are not obtainable from usual supply sources in the chemical industry.

Our staff is keyed to the creation of non-conventional equipment. Complete manufacturing, welding, forming, machining and finishing facilities permit all operations to be performed right here, under our direct control. And a quarter-century's experience in this field enables us to handle your most difficult assignments with dispatch and to your entire satisfaction.

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We will work directly from blueprints already in existence, or will have our engineering department work with you in developing specifications. Write, wire or phone—we'll be glad to discuss your problems, without obligation.

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tanning, and a number of other minor groups. American firms interested may get detailed information from Puerto Rico Industrial Development Co., 57 William St., New York.

Consulting Firm Aids Rayon Merger Case

AN ENGINEERING survey of North American Rayon and American Bemberg corporations is being conducted for the Department of Justice by Sanderson and Porter, well-known consulting engineers. The objective is the drafting of an application by the government to Securities and Exchange Commission authorizing stock transactions incident to the merger of these two firms now controlled by the Government. Justice Department officials are required by SEC to go through the same procedure in this case as would be required were a private corporation responsible for the transaction.

Selection of this consulting firm was made by Justice Department executives of the Office of Alien Property from approximately 75 proposals received from as many different consultants and consulting firms. These proposals ranged from a most cursory review to an extremely comprehensive and costly proposal of one firm which suggested a fee of a quarter million dollars for its services.

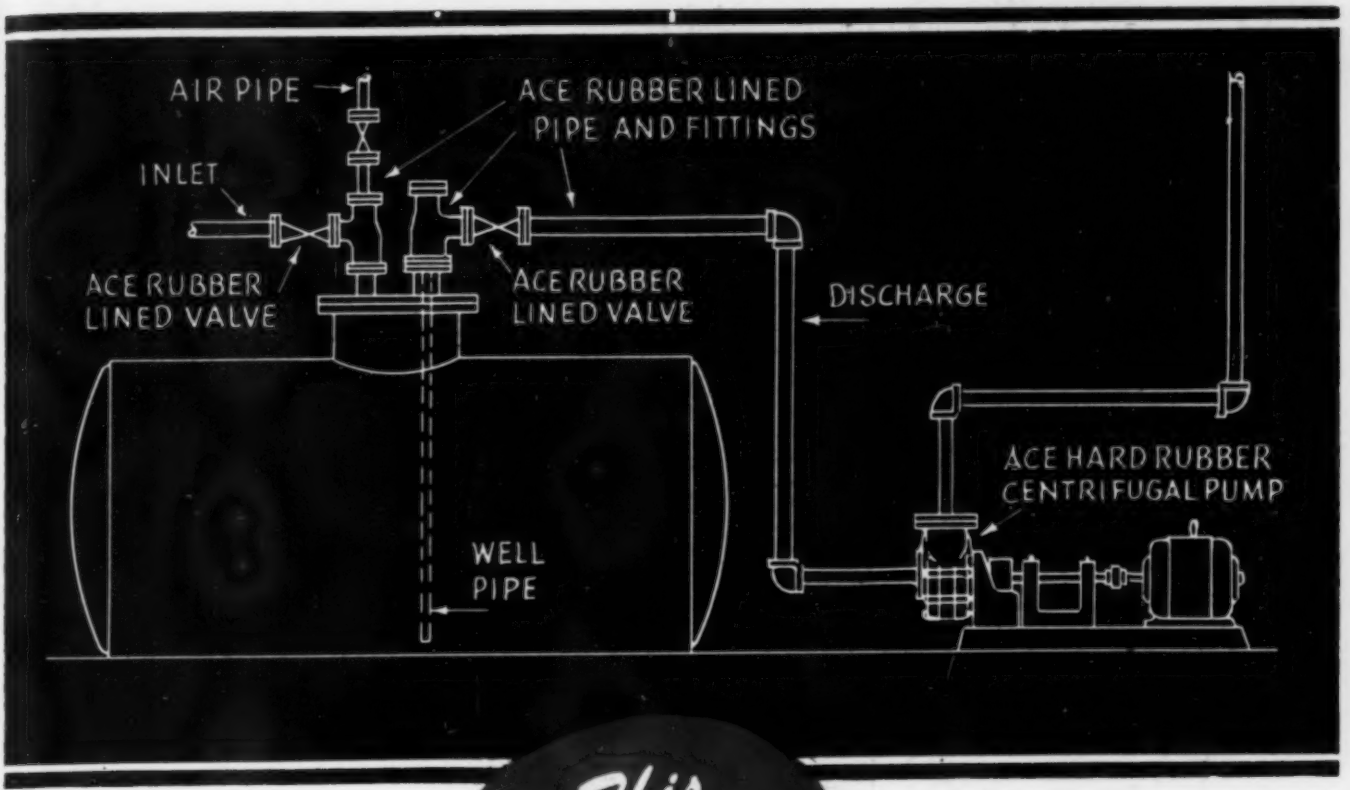
No estimates are yet available either as to the scope or the prospective time of completion of the present inquiry. It is generally believed about Washington, however, that no further formal step is likely to be taken by OAP until fall.

Humble May Build Research Center at Baytown

CONSTRUCTION of a $1 million building to centralize the company's petroleum refining research work was being considered last month by Humble Oil & Refining Co at Baytown, Tex. Bids were being taken for a three-story structure having a brick exterior with stone trim. The building is designed to house a library, laboratories, offices, lunch room, stock room, showers and a locker. The estimated $1 million investment includes the equipment.

Texas Gulf Producing Sulphur at Liberty

TEXAS GULF SULPHUR CO. has begun producing sulphur from its newest mining development near Liberty, Tex., although all facilities of the plant have not yet been completed. Initial production came from two wells



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When you add up all the savings you get by purchasing acids in tank car lots and storing it in ACE rubber-protected systems like this, with dependable ACE rubber-lined pumps and piping to feed it to your processes as required, you'll find the economy is almost unbelievable! You get lower prices, and lower freight and handling charges on bulk shipments.

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Standard ACE tanks are available in open-top square or round shapes, enclosed horizontal shell tanks like that shown above, or enclosed vertical tanks. There are ACE rubber-lined valves, pumps, pipes and fittings, and ACE all-hard-rubber piping and fittings to handle a wide variety of acids and alkalies.

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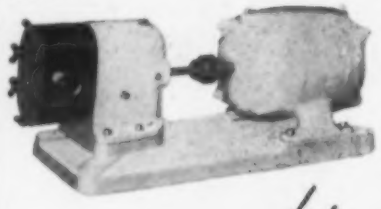




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opened during June by the company, which has rights over more than 3,000 acres in the vicinity. A production of around 250,000 tons annually is expected when the mine is fully developed.

Texas Gulf and Pure Oil Sign H_2S Agreement

PURE OIL CO. had some new wells at Worland, Wyo. It also had a problem: the natural gas was too sour to be used in its natural state. Solution came when a contract was signed last month with Texas Gulf Sulphur Co. In a plant to be completed next year, hydrogen sulphide will be extracted from 30,000,000 cu. ft. of natural gas daily. Texas Gulf will convert the H_2S into sulphur and return the remaining processed sweet gas and liquid hydrocarbons to Pure Oil. The development has been cited as an important conservation measure.

Overtime Charges Defined by Court

CONSIDERABLE controversy continues despite the U. S. Supreme Court decision as to the basis for overtime charges under the Wage-Hour law. The consensus in Washington seems to be developing along the following lines:

If an employee is engaged for certain jobs or certain schedules that by contract or company practice get certain premium pay rates, then this higher pay rate must be used as the "regular rate." Overtime payments are thus calculated on that special pay basis. But the Court disclaims any intention of "pyramiding" overtime payments on overtime payments.

It is expected that the Wage-Hour Division will interpret the law on this middle basis which recognizes a base rate higher for night services, for example, but does not recognize the higher rate of calculation which a number of unions have sought for their members. Any such method of pyramiding is certainly not required; but some believe that it might be made a part of a negotiated wage contract.

ASEE Honors Rouse and Christie at Austin

AT THE annual banquet of the American Society for Engineering Education held in Austin, Tex., two high awards in the teaching of engineering were conferred upon Hunter Rouse, University of Iowa, and Alex-

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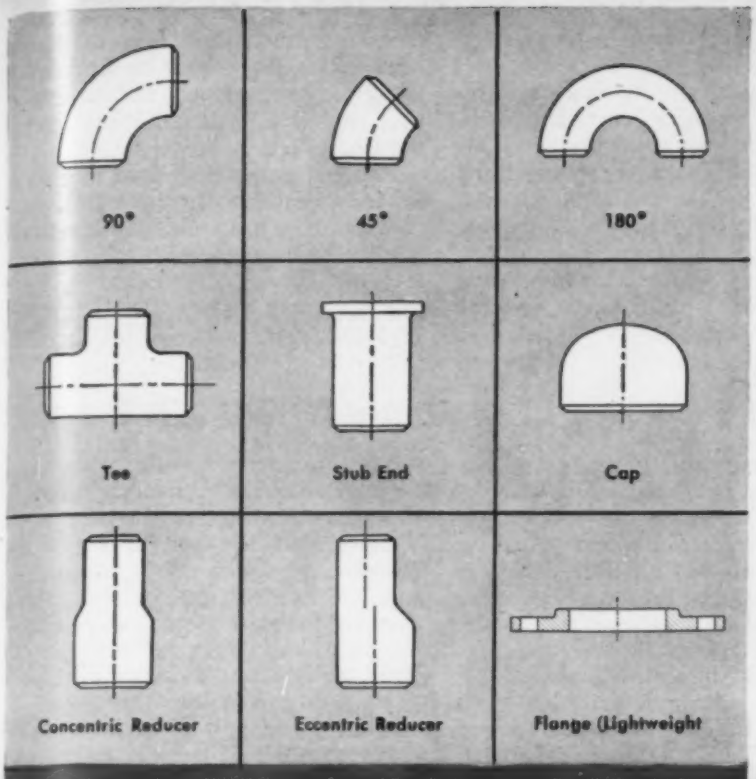
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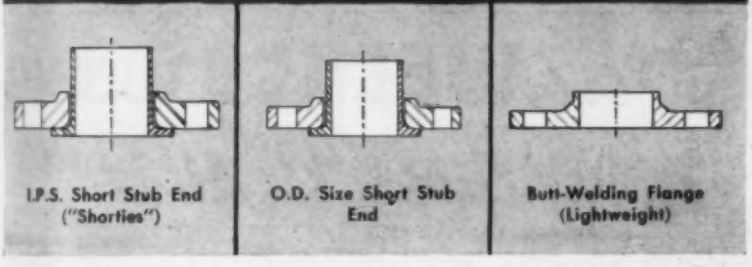
In just 30 seconds anyone can test viscosity with the Brookfield Viscometer — no special skills or technical training needed. Readings can be taken in lab or plant with equal ease, as instrument is portable and needs only connection to an electrical outlet. Now you can match laboratory standards in the plant and be sure of uniform results.

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Seamless stub ends for 10-S and 40-S piping with 150 lb. A.S.A. carbon steel lap joint flanges.

Seamless stub ends for O.D. tubing sizes with 150 lb. A.S.A. carbon steel lap joint flanges.

Lightweight stainless flanges (125 lb. American Standard diameter and drilling) for butt-welding to Schedule 10-S pipe.

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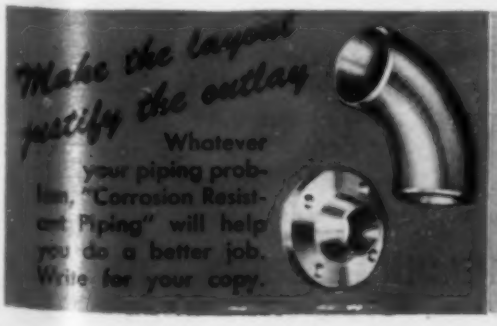
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Available in Stainless 304, 316, 347, Monel, Inconel, Nickel, Copper; also other usual industrial metals.

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the Titeflex Filter will save you money

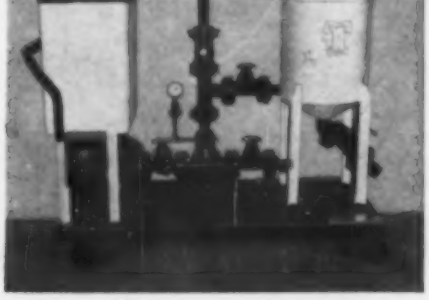
❶ No replacement parts

The porous filter membrane is a permanent part of the TITEFLEX Filter—there are no expensive filter pads or asbestos sheets to replace. All you need is a few cents worth of filter aid for each batch filtered. You not only save on material costs but also in the time consumed to replace filter pads.

❷ Completely self-cleaning

To clean the TITEFLEX Filter simply turn a couple of valves to reverse the flow. The "backwash" cleans the filter in ten minutes. Nothing to take out and clean—no mess—no time lost. The valuable man-hours you save can be used for more productive work elsewhere in the shop.

TITEFLEX Filters are compact, highly efficient units that give you sharp, clear filtrates with substantial savings in filter cost. Both portable and stationary models available. Write for descriptive literature.



Our new Model SLA 1000 filter with Saran-lined steel pipe and fittings and rubber-lined filter and precoat tank.

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ander Graham Christie, Johns Hopkins University.

Professor Rouse received "for distinguished contributions to the teaching of engineering students" a $1,000 check and a certificate representing the George Westinghouse Award, given annually by the Westinghouse Education Foundation.

Professor Christie, authority on steam power plants, received the Lamme gold medal "for achievement in engineering education. The Lamme medal is given annually from the trust fund left to the Society by Benjamin Garver Lamme, pioneer research engineer with Westinghouse Manufacturing Co.

Rouse is professor of fluid mechanics and director of the Iowa Institute of Hydraulic Research. His citation was for "extensive influence upon the teaching of fluid mechanics; for his revealing syntheses of diverse information; and for his inspiring guidance to students and associates."

READERS' VIEWS AND COMMENTS

Universities and Patents

To the Editor:

Sir:—I have read your editorial entitled "University vs. Industry." You have done a real service in calling attention to this impending disaster to both our educational institutions, and to our future in industrial research.

Happily, common sense dictates a very logical middle ground as the area in which universities can properly function with due benefit to themselves and to the nation. That ground is best defined by the definition of a true university: a place where men are taught. That teaching may be in the ordinary sense, or in the more important one, the true mission of a great university, to contribute with untouched intellectual honesty to the scientific knowledge of our time.

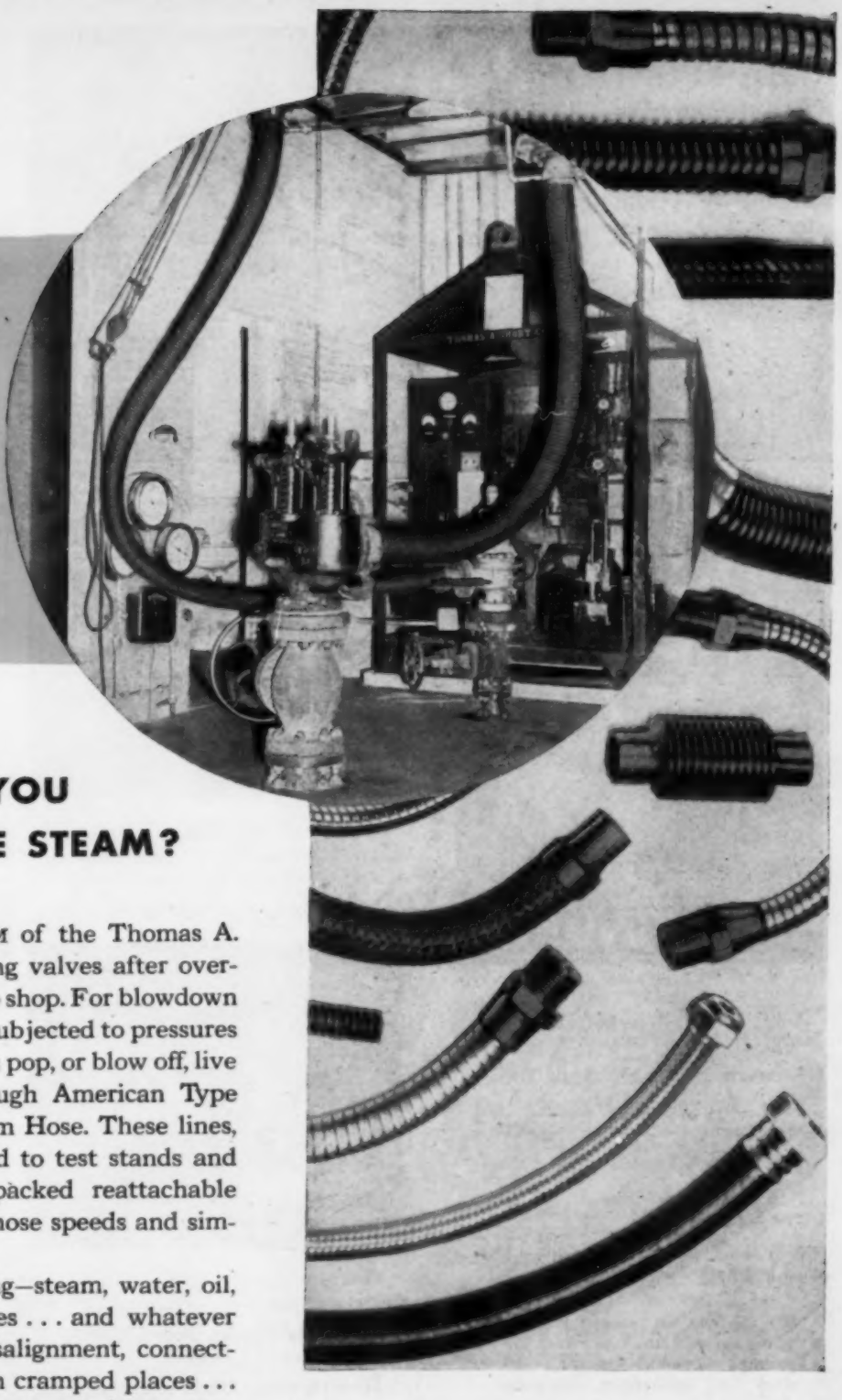
Long practical experience with a research foundation of a great university, and in many dealings with other research foundations and universities generally, has taught me one thing: that a university is no longer a university when it goes into the marts of commerce and sells its endowed and publicly supported facilities to private contractors for their private monopoly. When research of fundamental character is directed for the purpose of inventing a patent to foster a synthetic monopoly rather than to patent an invention, then such research is no longer that of independent scientists



Weldco is made by tubing specialists . . . experienced men who *know* their product and have *complete* mill facilities at their disposal. Weldco tubing is automatically welded in a continuous machine, under pressure, that insures complete uniformity all the way through. It's properly formed, carefully finished, rigidly checked, to give you a top-quality product that's mechanically and metallurgically sound. Weldco tubing is available in Monel, Stainless, Inconel, Nickel and other alloys, in sizes from 3-1/2" to 30" O. D.—other sizes on request. Send today for your free copy of the new Weldco booklet.

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HOW WOULD YOU HANDLE THE LIVE STEAM?

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exploring the unknown without hope or personal gain or the limitations of personal direction.

The need for intelligent honesty in this matter is serious. To say that the university wishes to make money and that its endowments are insufficient is to confess moral bankruptcy.

A case in point will illustrate what I mean: I have known repeated instances of the suppression of a Ph.D. thesis after the date of awarding the degree because the recipient of the degree was financed by a grant from a commercial company on condition that the results of his work should be suppressed from the public domain in order to protect the commercial interests of the sponsor.

You can no more commercialize voting or marriage than you can commercialize the highly sacred relationship of the university professor and his students with respect to the common store of knowledge that should belong to all men without fee. The ethics involved in these three situations are entirely comparable.

I had occasion recently to argue in the Supreme Court of the United States the necessity for exempting scientific discoveries and the discoveries of the law of nature from the patent law. Seven of the nine Justices agreed with me, and held that you cannot monopolize by patents fundamental research and the fundamental scientific developments of our time. Such is now the law of the land.

This, it would seem to me, would conclusively establish the fact that a public institution should confine itself to research, the results of which will be open to the public and not subject to private monopoly.

I see no difference between the commercialization of virtue and the commercialization of intellect devoted to the public interest.

Dr. Palmer and Dr. Williams have done a great public service, and your editorial is equally significant.

If we persist in polluting the well springs of our scientific information by commercial restrictions of patents, emanating from public institutions, we will wreck both the patent system and our educational institutions.

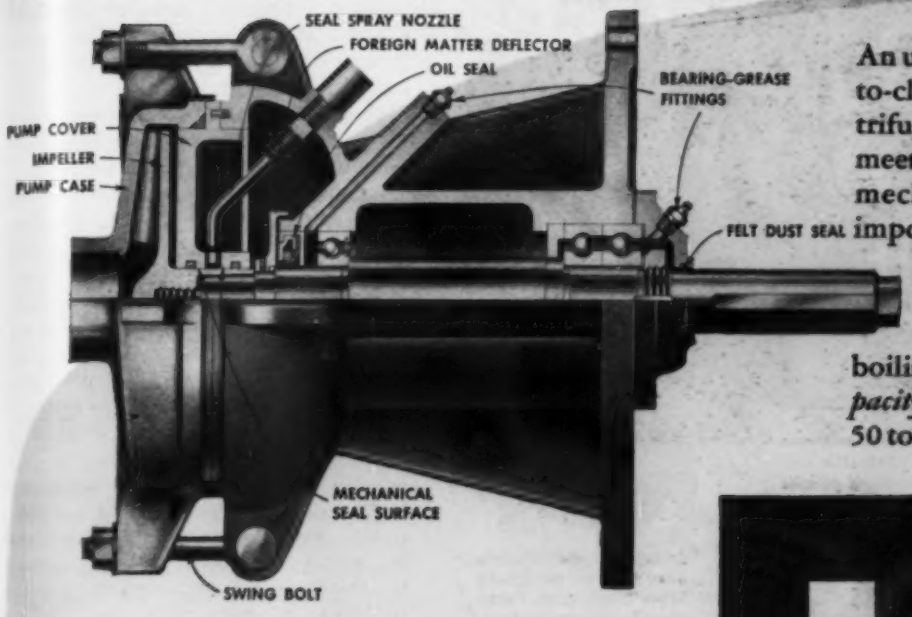
H. A. Toulmin, Jr.

Toulmin & Toulmin
Dayton, Ohio

Five Is Minimum

To the Editor:

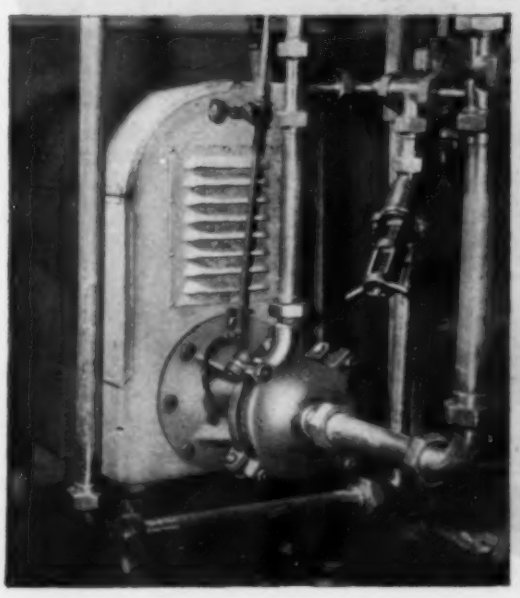
Sir:—I have read with interest your leading editorial entitled "Four, Five or Six Years?" in the April number of "Chemical Engineering" and am writing to call your attention to an error. So far as Cornell is concerned, all engi-



An unusually compact, easy-to-clean, selective speed centrifugal pump... designed to meet exacting sanitary and mechanical requirements imposed by food evaporation processes that operate under high vacuums and high boiling temperatures. *Capacity:* 20 to 100 gpm. *Head:* 50 to 200 ft. *Speed:* Selective.

The New BJ Sanitary Food Process Pump

This is one of a large number of BJ Sanitary Food Process Pumps installed by Golden State Co., Ltd. For standard application, pump is mounted on sturdy sheet-metal cabinet containing drive motor, as indicated. Selective Vee-belt drive provides for flexible adaptation to variable power and speed conditions. Discharge nozzle can be rotated to any one of four positions. If desired, pump is sold separately for special mounting.



CONVENIENT DISMANTLING AND CLEANING—Pump can be dismantled for cleaning with a few simple manipulations. Case is held by four swing bolts, impeller by a simple bolt threaded into impeller hub.

MECHANICAL SEAL—A simple, water-cooled-and-lubricated mechanical seal assures a trouble-free, easily cleaned stuffing box.

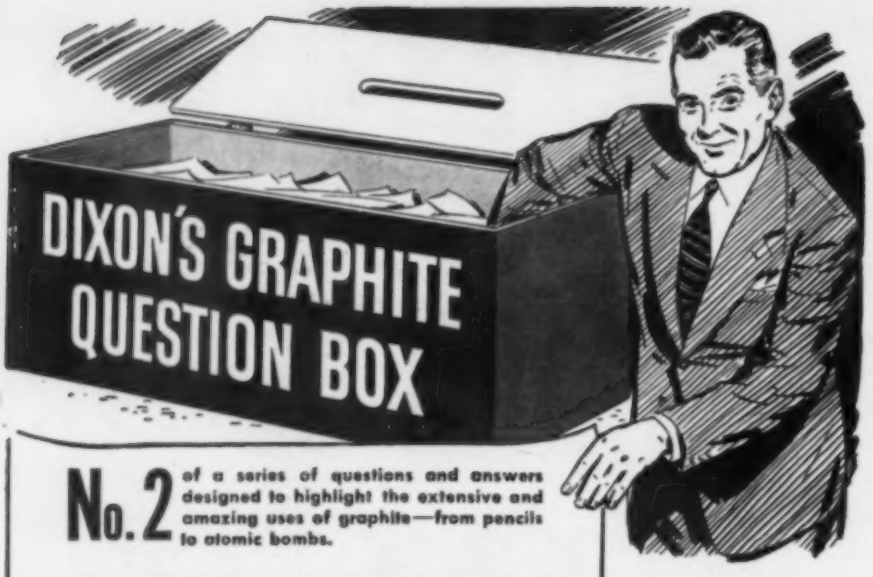
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ANS. Extremely unctuous. Lustrous and opaque. Withstands excessively high and low temperatures. Fusibility unknown but probably about 3000° C. Combustible in the presence of oxygen at about 620° C., but not altered by heating in a vessel free from air. Chemically inert. Good electrical and heat conductivity. Low co-efficient of expansion. Non-magnetic, non-fusible, non-toxic, non-odorous, and does not permanently stain. Specific gravity: 2.1 to 2.3. Moh's scale of hardness: less than 1.

QUES. What are *some* of the products or processes in or on which graphite is used?

ANS. Tungsten and molybdenum wire filaments
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Hydraulic pump piston and piston rod lubricants
Extreme heat-and-pressure-resisting lubricants
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Pipe joint compounds and seals
Brake linings
Paper (lubricating and transfer)
Typesetting machine mold, space band and mouthpiece lubricant
Wire drawing
Oil-less, self-lubricating bearings
Transmission chain lubricant
Transmission rope and cordage lubricants
Trolley wire lubricants
Protective surface coatings with lubricating qualities
Impregnated lubricating metals, plastics, rubber, felt, fabrics, leather, paper and wood
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Mechanical oven, lehr and kiln chain lubricants
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(*To be continued in No. 3*)

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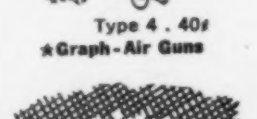
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Now may we receive *your questions* on how graphite can help *you?*

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neering curricula leading to the bachelor's degree are straight five-year courses. We do not offer a degree in general engineering, nor do we award a degree at the end of four years.

It is our purpose to train engineers with a sound basic scientific and technical training in parallel with more general studies. The inclusion of these latter subjects led us to the five-year programs in all courses. We could not see how any sacrifices could be made in the scientific and technical content. We, therefore, could not see how we could meet our objective in four years without a dilution of the necessary technical training required for an engineering degree.

It is quite true that a considerable portion of our engineering graduates have gone into executive and administrative positions. Those who have done so have achieved these positions largely because they have demonstrated their ability as good engineers and their capacity for additional responsibilities beyond the technical field. It is neither in the power of the student nor of the school to determine in advance the position a graduate will hold after 20 years in the profession. We believe, therefore, that all our engineers should be trained not only with great thoroughness in the technical field, but also with attention to the fundamental liberal subjects which would broaden their outlook and abilities for executive administration as respects the economical, social and political life of their time and the responsibilities in those areas as presented by their executive and technical duties.

S. C. Hollister

Dean
College of Engineering
Cornell University
Ithaca, N. Y.

Isobar, Isotherm, Isosyst

To the Editor:

Sir:—In this laboratory's work in phase equilibrium, a concise, descriptive, unique word was needed to describe the condition of the same composition throughout a given experiment, or to label a curve of constant composition. The words, isobar and isotherm have long been used to label conditions of constant pressure and constant temperature respectively, but no such apt or concise word exists to replace the cumbersome and verbiose "state of constant composition."

Thus, for vapor-liquid equilibria, temperature may be plotted versus composition for various isobaric conditions and similarly pressure, versus composition along isotherms. The third condition, pressure versus tem-



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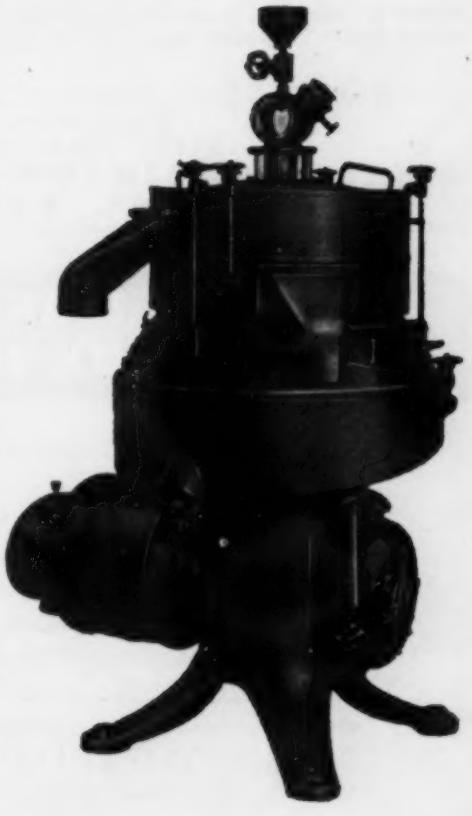
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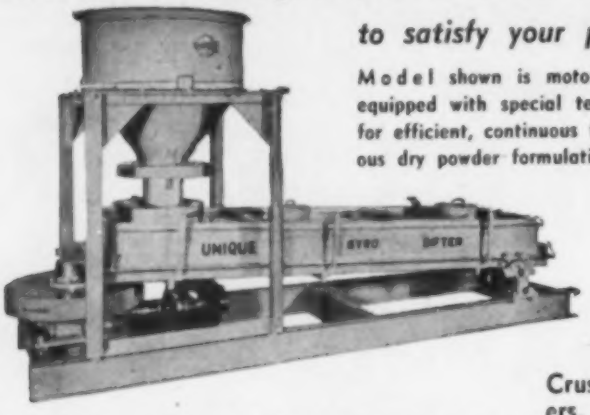
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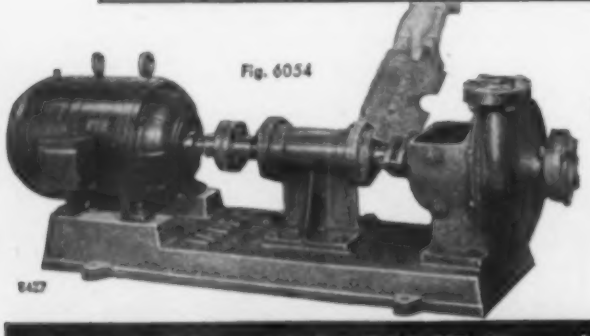
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perature, is plotted for "envelopes of constant or the same composition" as a parameter. Such wordiness in an era of abbreviation represented even by the extremes of governmental "alphabet soup" and bathing suits is unnecessary.

The word must be descriptive, easily pronounced, adaptable to international use, capable of easy recognition, and euphonious if possible. The prefix "iso" seems logical for describing "the same" or "equal." Ready parallel is available for this choice and apparently automatically the remaining stem must be from the Greek to avoid mixed origin. "Systasis"—composition, constitution, etc.—has much in its favor. The choice therefore inclines to the definitions:

iso-syst-*n* (fr. Greek iso = equal, systasis = composition) a state of equal or the same composition.

iso-systic-*a*-applied to an iso-syst as, for example, an iso-systic curve.

It is hopedthat those in the physical and chemical sciences needing exactly descriptive words may find some use for this word.

V. C. Williams
Chairman
Chemical Engineering Department
Northwestern Technological Institute
Evanston, Ill.

For Local Option

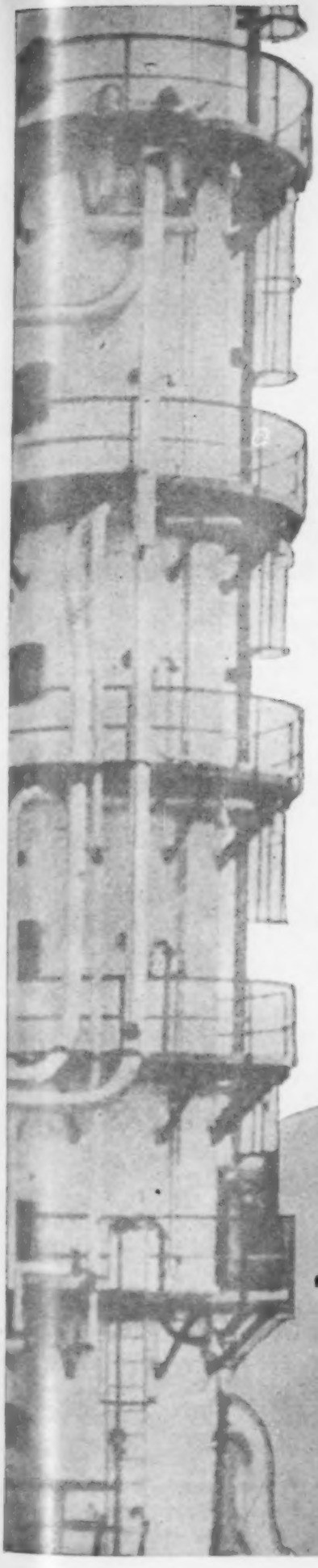
To the Editor:

Sir:—This is a somewhat belated compliment on the "*Chem & Met*" report entitled "Synthetic Fuels" in your June issue. It is the most complete survey of Who's Who in this field that has been published.

Undoubtedly the investigators in this field have a variety of motives depending upon their stake in the results. My company sees this field as a large potential market for its coal, provided process and product economics develop satisfactorily in the gasoline consuming areas which coincide with our principal coal reserves. It follows that United States and world reserves, supply and demand are significant to us only as they affect crude oil prices.

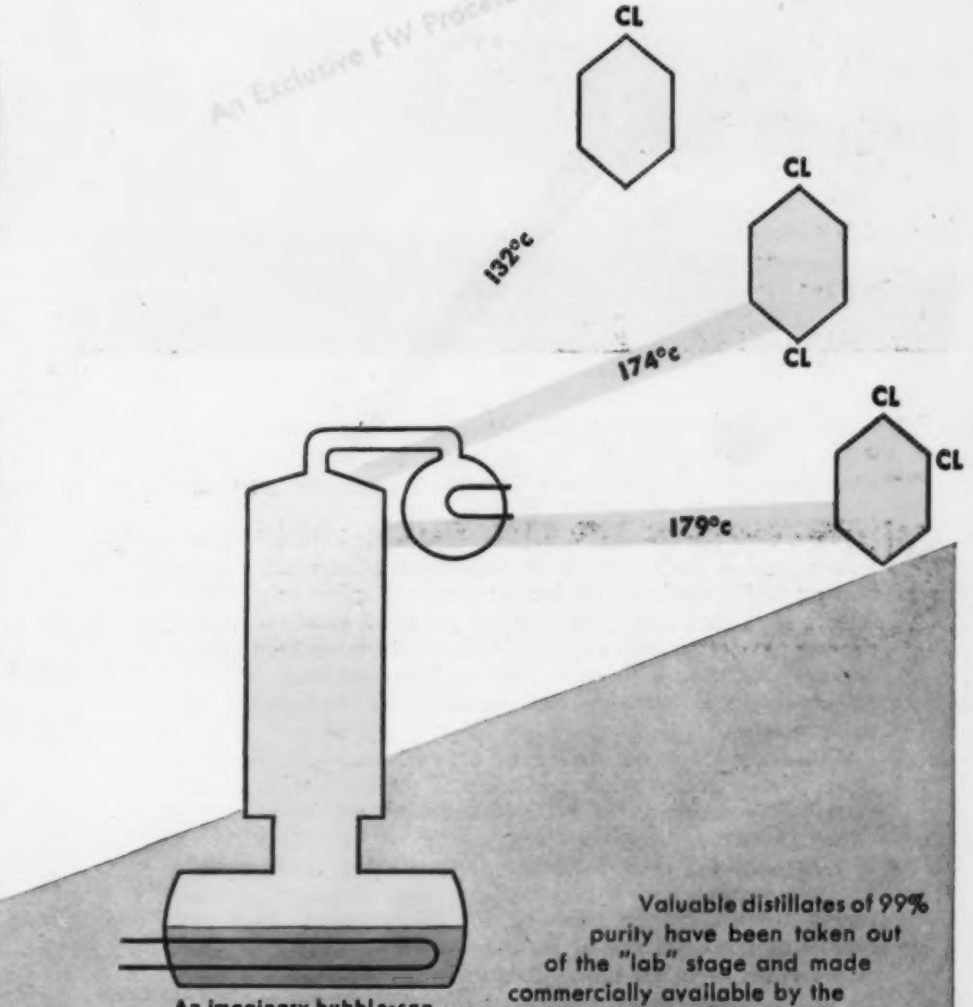
We do not look upon our work here, with its local objectives, as offering any important relief to the present oil market, although the results of these studies can help provide the experience which may someday be needed if the national interest or fuel economics over a broad area, requires synthetic oil from coal on a large scale.

H. S. Turner
Director
Research and Development Division
Pittsburgh Consolidated Coal Co.
Library, Pa.



...Mole-hill out of a Mountain

A Small, Compact Unit with Stedman Packing Achieves Maximum Separating Efficiency in the Fractional Distillation of Organic and Mineral Oils



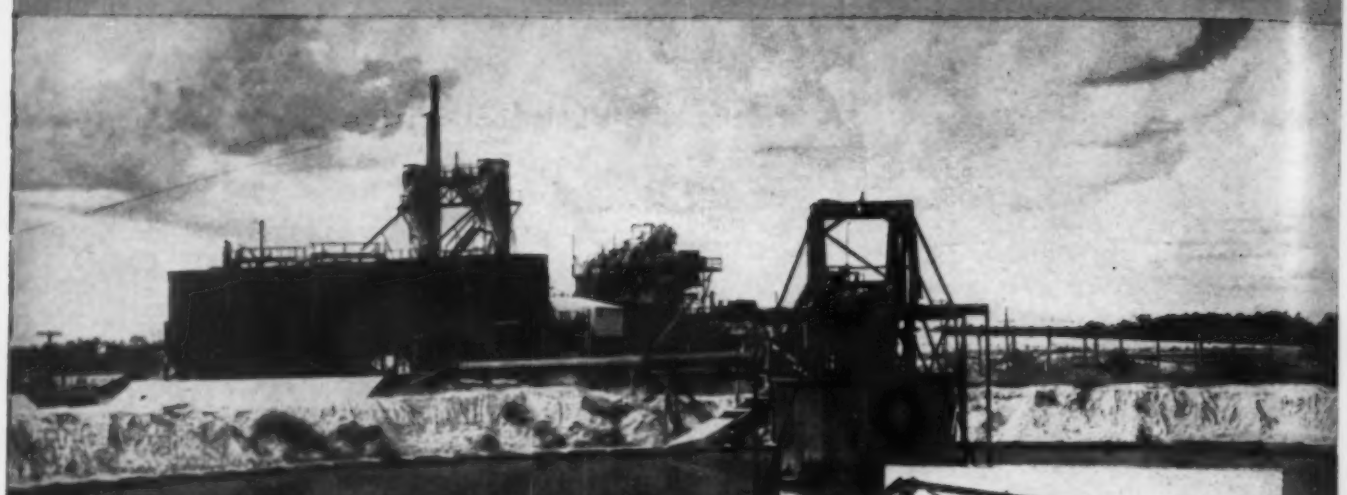
An imaginary bubble-cap column, 400 feet high (left), would be required to approximate the performance of the 25-foot Stedman-packed fractionating column (above).

Valuable distillates of 99% purity have been taken out of the "lab" stage and made commercially available by the FW Stedman fractionating process—now applicable to an infinite range of chemical products... Inquiries are invited from any source where difficulties are encountered in obtaining the desired purity of fractionated products. Write

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What's more, your thickener tank can be utilized as a temporary storage tank to absorb tonnage surges, and automatic controls can be supplied for this purpose. This will also permit the storing of feed during week-end or off-shift shut-downs. With the mechanism idle, the hydraulic lift takes care of the start-up as easily as with an empty tank.

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NEWS FROM ABROAD

Special Correspondence



India worried about lac situation . . . Canada has new resin process . . . Russia working on underground shale gasification . . . Australia hears costs warning.

Indian Lac Industry Worried As Siam Increases Exports

THE INDIAN lac industry is casting a troubled eye towards Siam as that country steadily increases its own export trade in the commodity.

Pressure for better quality and pricing policies is increasing as the threat of a competitor exporter is added to the threat of replacement by synthetic resins.

Trade figures available here show that Siam exported during the first nine months of last year 10,000 long tons of stick lac and 1,500 long tons of shell lac. Prewar her exports averaged about 5,000 long tons of stick lac, mostly to India.

Now she is reported building lac refineries with an annual capacity of about 6,000 long tons. If they are completed and get the material this would represent a cut of 30 percent into India's recent exports of about 20,000 long tons annually of button, seed and shell.

Vancouver Resin Plant Uses New Process

WITH one eye glued to British Columbia's increasing demands for synthetic plywood resins, Andrews & George Co., Ltd., decided last year to go into the resin business. By now the other eye is firmly resting on a new manufacturing process which may revolutionize the industry.

In late 1947 a semi-commercial plant was put into operation at Vancouver, B. C. Since that time it has turned out over 500,000 lb. of finished phenolic and urea resins, now has a rated capacity of 2,500,000 lb. yearly. Significance of the development lies in the small plant area: it's only 60 x 120 ft. All operations are handled by 15 men. The high production rate stems from an entirely new process developed and put into operation by plant manager Thomas C. Baxter. It involves the usual phenol-formaldehyde condensation. A second process for urea resins is being refined as production proceeds.

Prewar, 80 percent of B. C.'s plywood resins used were of soybean base; only 20 percent were phenolic. Wartime advances in materials changed things. Phenolics now tip the scales with 60 percent. Phenolic-made plywood is popular in prefabricated homes and other building developments, such as forms for concrete. Urea resin is filling a demand in the furniture industry where finished plywood must not be stained by bonding substances. A whopping 5,000,000 lb. of phenol, 13,000,000 lb. of formaldehyde and 500,000 lb. of flake caustic are used annually in this regoin alone. Urea resins consume 1,000,000 lb. of urea crystals, 3,000,000 lb. of formaldehyde.

But if the plywood resin industry in British Columbia is already booming, it is likely to swell to even greater proportions in the future. Lumber tracts now held have a 75-yr. wood supply, and scientific cutting and reforestation demanded under government timber licenses may extend this figure. A large new market may develop from utilization of wood waste in grainless hard board panels. Low pressure processes and impregnation of sawdust, hog fuel and sander dust with resins highlight this development. One such mill is already operating near Vancouver.

With plywood manufacture on the increase, some 70 percent of the region's plywood is now exported, primarily to the United Kingdom. Importers and exporters to the Orient since 1894, Andrews & George sees a world-wide market. Chances are the firm will get into both ends of the business by producing its share of resins at home, exporting its share of plywood abroad. Headed by R. M. Andrews, Jr., the firm maintains offices in Japan, China and the Philippines.

Farben Officials Cleared on Aggression Charges

ALL 23 former officials of I. G. Farben were cleared of charges of crimes against peace last month. The nine convicted of plunder in subjugated countries were: Herman Schmitz, George von Schnitzler, Fritz Ter Meer, Ernst Buergin, Paul Haefliger, Max Ilgner, Friedrich Jaehne, Heinrich Oster, and Hans Kugler.

Four were convicted of using slave labor. They were: Otto Ambros, Heinrich Beutefisch, Walter Duerrfeld and Karl Krauch.

The charge that they had hampered industrial development in other countries through a network of spies was not proved. The defense showed that the cartel lived up to its patent exchange agreements.

New Indian Firm Will Erect Paper Mill

THE FORESTS of India's Central Provinces soon are to have a second paper mill under construction, based on a unique concentration of raw materials available in the hitherto unexploited area.

The new company, authorized to sell stock totalling $6 millions, is the Ballarpur Paper & Straw Board Mills Ltd.

Back of that imposing name are several interesting facts. One is that the provincial government will hold a majority stock interest although the management itself will rest with a firm of managing agents whose profits are contractually limited.

Second is that John Inglis Co. Ltd., of Toronto, which is supplying the machinery is taking nearly $500,000 worth of stock as a "guarantee of sound manufacture of an efficient mill."

The third is that the company

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12. Large Capacity Nozzles
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Please state how nozzles will be used, and give capacity of installation.

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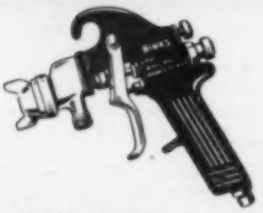
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holds a 40-year lease on 137,000 acres of bamboo forest to feed its projected 40-ton a day plant.

The company plans to manufacture high-grade writing and printing paper, packing paper, cardboard and strawboard, and woodpulp and chemical pulp.

The 1947 production of paper of all types (exclusive of newsprint) in India was approximately 87,000 long tons compared with imports of about 50,000 long tons. But official panels state that within five years production should be increased to about 300,000 long tons. At present the annual consumption works out to only 1 lb. per capita compared with 241 in the United States.

The other important mill under construction is that of National Newsprint & Papermills Ltd. for which Robert A. Rankin & Co. of Montreal are consulting engineers. It hopes to be in production by the end of 1949 with a capacity of 100 long tons of newsprint a day. It will use "salai," a broad-leafed soft wood.

At present India is importing about 30,000 long tons of newsprint a year. Officials estimate that 100,000 long tons could be used if available.

Russians Trying Underground Gasification of Shale

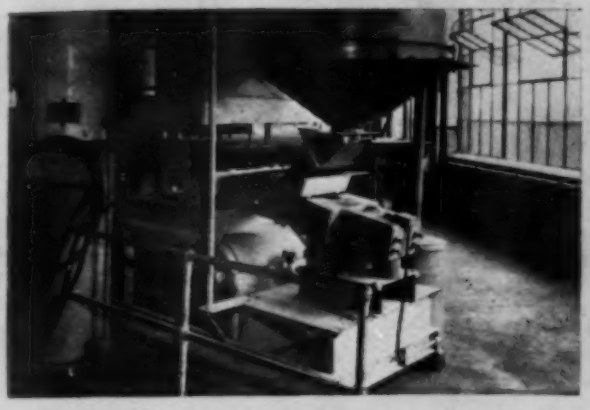
Soviet fuel engineers have "in the main solved the problem of underground gasification of coal," S. I. Vavilov, President of the USSR Academy of Science, recently stated, adding that "a method for underground gasification of shale is being worked out."

Meanwhile industrial power experts are thumping for intensified effort toward completion of the current five-year program which called for "increasing the output of gas through underground gasification by 1950 to 920 million cubic meters per year."

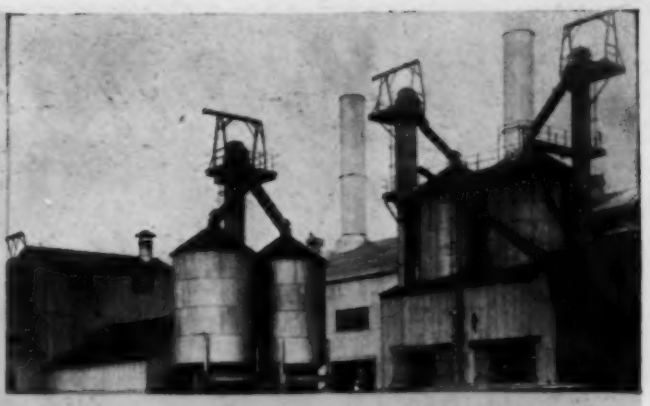
Citing this goal in a recent article that noted Soviet pioneering work in underground gasification as a means to utilize low-grade coals and provide cheaper fuel, A. B. Chernyshev, corresponding member of the USSR Academy of Sciences and a prominent colleague in the Academy's Power Institute, expressed confidence that the combined efforts of Soviet engineers, scientists and workers would result in converting "underground gasification of coal into an independent branch of industry."

Academy correspondent Chernyshev noted that Soviet work in this field has been underway since 1931 when at the initiative of Stalin a Government Commission for underground gasification of coal was established. Under its auspices the "Podzemgas"

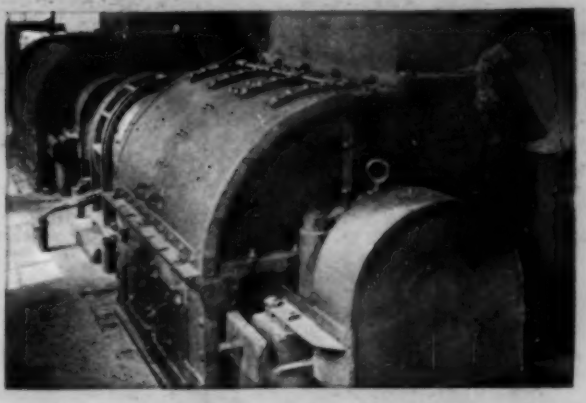
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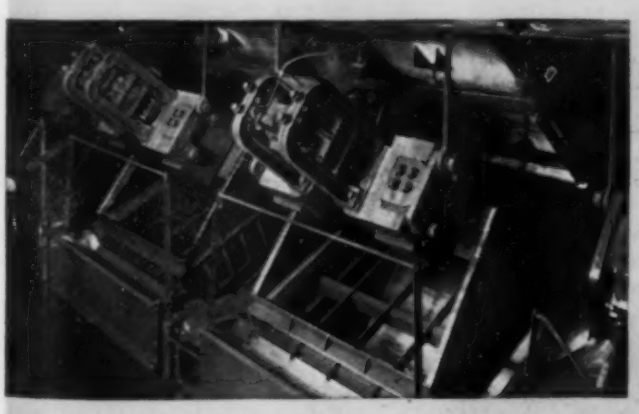
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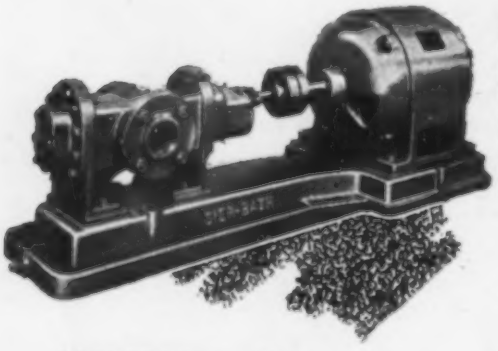
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WE believe that no pump used in industrial processes can be too good. The cost of only one shut-down for pump replacement or repair often exceeds the difference in price between the best pump it is possible to obtain—and the second-best.

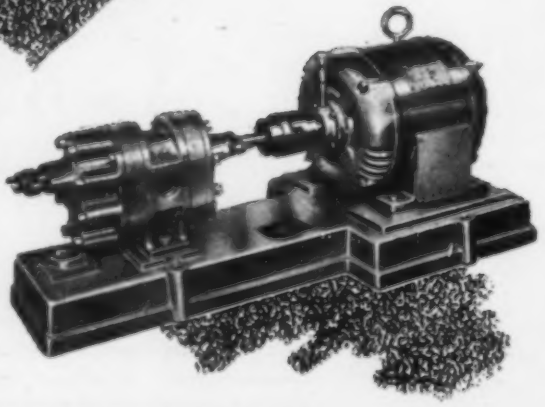
That is why we put *everything* that engineering ingenuity can devise into Sier-Bath Screw Pumps and Gearex Pumps. As a result, Sier-Bath Pumps are noted for their dependability and durability and for requiring the absolute minimum in down-time for maintenance.

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SIER-BATH Gearex Pump
Advantages: balanced axial thrust, vibrationless operation, roller bushings for precision running under load. Pumps oils, varnishes, solvents, molasses, chemical solutions. Capacities 1-550 g.p.m. Discharge 250 p.s.i. for medium or high viscosities, 50 p.s.i. for water.



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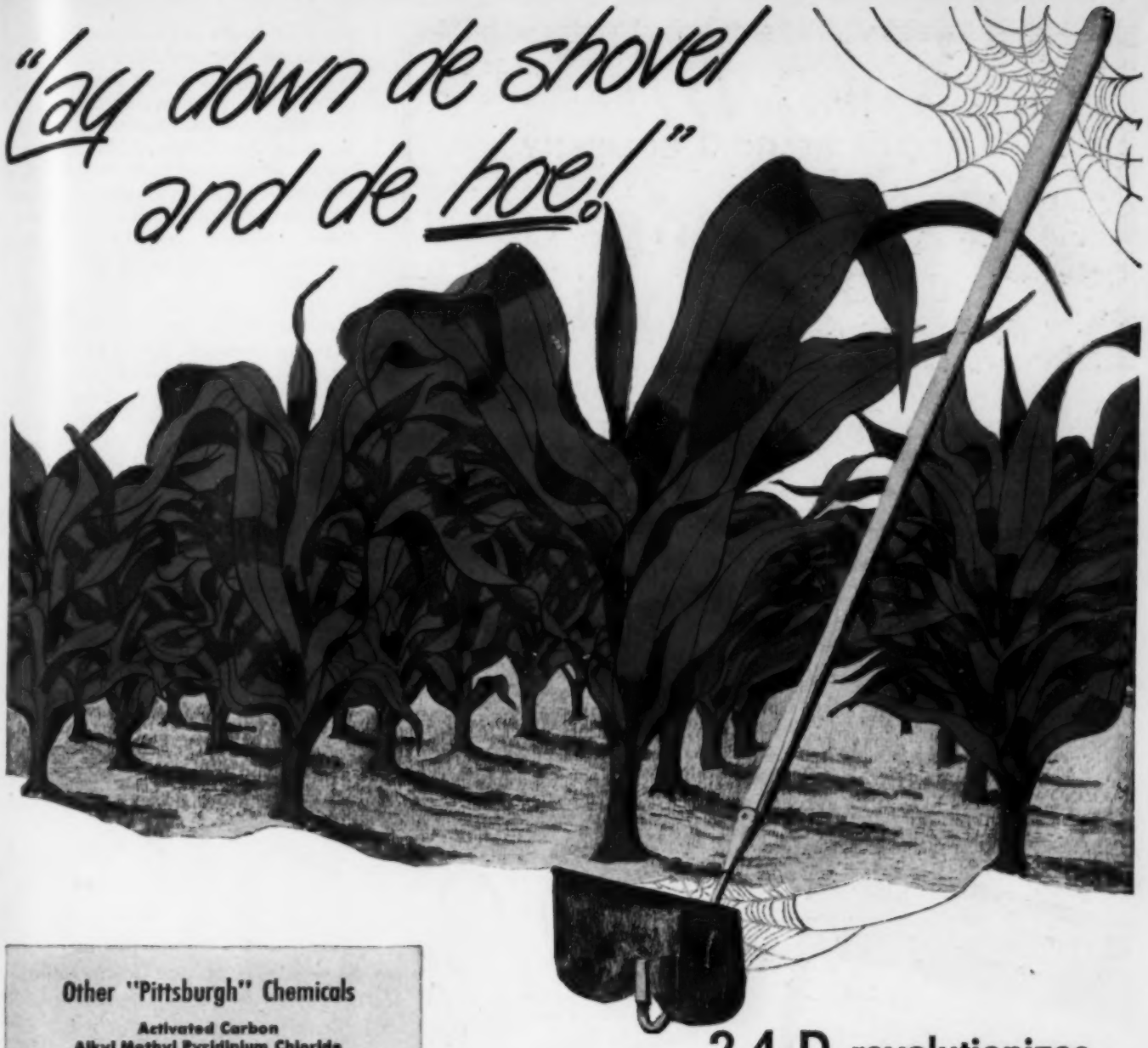
(underground gasification) trust was organized in 1932, and six years later the experimental station established in the Donbass produced by underground gasification gas that was used in firing the boilers of a coke plant "for the first time in world technique." Results were "entirely satisfactory" and in 1940 a second plant for underground gasification of coal was established in the Moscow coal basin.

Commenting on this enterprise which was interrupted by the war against Hitler Germany, power expert Chernyshev, noted here for his contribution toward higher productivity of coke-chemical plants, stated: "The work of the experimental stations demonstrated the practical realizability of underground gasification, but at the same time disclosed the necessity of solving a number of scientific and engineering problems associated with wide industrial application. . . . At present engaged in rehabilitating and developing the national economy, our country must again resume on a wide front work in underground gasification of coal."

Opening the way toward utiliaztion of coal deposits without mining, and thus tapping the country's greatest fuel reserves, underground gasification is considered potentially the most significant of four sources from which Soviet industry obtains its supply of gas which is regarded as the most economical fuel. The other three are: 1) coke-chemical plants, 2) gas-generating stations at metallurgical, machine-building, glass, chemical and other plants that convert all forms of hard fuel—coal, peat, shale—into fuel gas; and 3) natural gas obtained from underground wells and piped to consumers over as many as 500 miles as in the Saratov-Moscow pipeline, longest in the country, yet delivering cheaper gas in Moscow than can be produced by local gas generating plants. Tremendous expansion of the natural gas supply is currently underway with new pipelines being constructed from Trans-Carpathian deposits to Kiev, and in Central Asia. Under the five-year program by 1950 output of natural gas is scheduled to reach 8,400 million cubic meters per year.

Australian Chemical Institute Hears Warning on Costs

A WARNING that the real test for Australia's chemical industry is going to come in a few years' time, when international currency affairs have straightened out and the pent-up consumer demand for chemical products has eased, was sounded by Dr. J. Vernon in his presidential address to



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In this day and age, Uncle Ned of the folksong, wouldn't have had to go to his reward in order to "lay down de hoe"! For *chemical weed control* is now an accepted agricultural fact.

Widespread field tests in the past few years have proved that the application of 2,4-D (2,4-Dichlorophenoxyacetic acid) is highly effective for weed control in crops such as corn, wheat, oats, rye and barley, rice, and sugar cane. Not only has it been proved an effective weed control but it has also increased the vigor and yields of agricultural crops.

2,4-D is only one of a wide variety of agricultural chemicals, including insecticides, fungicides, germicides and rodenticides which are produced and marketed.

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Controls for air, water, steam, natural, manufactured and liquefied petroleum gases, light and heavy oils, etc., refrigerants such as: freon, methyl chloride, sulphur dioxide and ammonia.
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GENERAL G&C CONTROLS
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the New South Wales Branch of the Australian Chemical Institute.

Dr. Vernon said that the chemical industry of Australia has been protected from American competition by shortage of dollars and the resulting import restrictions, from British competition by England's preoccupation with her own desperate affairs, and from Continental competition by the political chaos prevailing throughout Europe.

Dr. Vernon recalled the evidence given before the Tariff Board at hearings on chemical items, particularly plastics. These hearings had highlighted the cost factor in Australia's chemical industries and had shown that many producers can operate only behind a sheltering wall of tariffs and import restrictions. But there will be increasing pressure from overseas manufacturers to gain a foothold in the Australian market. And to keep her own export markets, Australia will have to sell at world parity prices.

Key Chemicals

Dr. Vernon sketched the position of a few key chemicals as follows:

Sulphuric acid—About twenty plants in operation, mostly as adjuncts to fertilizer plants. Imports of sulphur may be permanently reduced to one-third of prewar quantity through increasing use of pyrites and zinc concentrates.

Nitric acid—The only starting material before the war was imported sodium nitrate. Equipment is now available for oxidation of synthetic ammonia.

Nitrogenous Fertilizers — Limited prewar capacity for gas works and coke-oven ammonium sulphate have been supplemented by synthetic ammonia of capacity sufficient to supply practically all Australian needs. However, the economic future of the synthetic plants could not yet be said to be assured.

Potash Salts—Dependence on imports has been partly reduced by recovery of potash fertilizer from Western Australian alunite.

Methanol—Synthetic methanol is produced in sufficient quantities to meet Australian needs.

Formaldehyde—Two plants, using locally produced methanol, can produce Australia's requirements for the plastics industry.

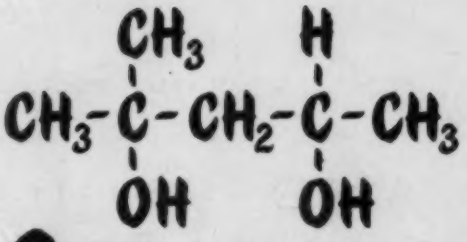
Phenol—Two plants supply all Australian requirements.

Alkalis and Chlorine—A decision by ICI to double soda ash capacity at its South Australian plant has recently been announced.

Acetone—A large synthetic acetone plant was erected during the war.

Trichlorethylene—This solvent is in

From SHELL CHEMICAL



Hexylene Glycol

A new plant at Houston, Texas has greatly increased the supply of this valuable solvent

PROPERTIES

Molecular Weight	118.17
Specific Gravity 20°/4°C	0.9216
Boiling point (760 mm.)	198.27°C
Flash Pt., Cleveland Open Cup	230°F
Vapor Pressure at 20°C	0.02 mm. Hg
Refractive Index, n_D^{20}	1.4276
Viscosity at 20°C	41.7 centistokes
Weight (pounds per gal. at 20°C)	7.69

Among the many other Shell Chemical products are Tertiary Butyl Alcohol, Diacetone Alcohol, Allyl Alcohol, Diisobutylene and Acrolein

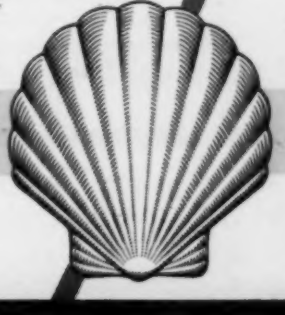
A data sheet and sample will be forwarded on letterhead request. Write your nearest Shell Chemical office.

HEXYLENE GLYCOL is a colorless, nearly odorless dihydric alcohol which is miscible with water and an unusually large number of dissimilar chemicals.

AS A COUPLING AGENT it offers distinct advantages in the formulation of *hydraulic brake fluids* because of its water tolerance, lack of rubber swell and compatibility with castor oil in all proportions. In addition, its chemical stability, viscosity index, lubricating properties and non-corrosiveness are equally satisfactory. HG is also widely used as a coupling agent and emulsion stabilizer in *engine cleaning compounds* and *"soluble" cutting oils.*

AS A SOLVENT its steep vapor pressure curve, good resin solvency and comparatively mild hygroscopicity make it particularly useful in the manufacture of "flash dry" and other types of *printing inks.*

AS A PENETRANT its mildly hygroscopic character, plus notable softening and coupling properties, suggest its use as a component of *yarn lubricants, mercerizing assistants and other textile chemicals.*



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To the friendly tax laws (or lack of unfriendly ones) can be added many other reasons why you should build your chemical plant on the Texas Gulf Coast:

Here you will find a superabundance of sulphur, salt and hydrocarbons — the big three basic materials upon which the chemical industry feeds. Also at hand are raw resources in variety and quantity unmatched elsewhere.

Plus: rail, water, highway and air transportation to all markets; economical, *natural* gas for fuel; cooperative labor; an abundance of pure water; and a moderate climate inviting to both work and play

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good supply from local production.

Phthalic anhydride—A plant at Newcastle makes possible the production of glyptal resin finishes and of phthalates for use as plasticizers and insect repellents.

Phosphorus — Production of elemental phosphorus, phosphoric acid and food phosphates from imported phosphate rock has now been put on a firm basis.

Drugs — Manufacturers include sulphfanilamide, sulfphaguanidine, penicillin and ascorbic acid.

One shortcoming of the Australian chemical industry is its lack of researchmindedness. Although there are about 300 chemical concerns, a reliable authority estimated for McGraw-Hill World News that these employ only about fifty chemists on development or research projects. This is partly due to the fact that most plants operate as subsidiaries of British and American parent companies which supply all technical know-how.

Nevertheless, in the chemical industry, with its localized raw material, climatic and market problems, there is perhaps more need for research than in any other industry. It is a fact that the chemical industry of Australia does not exclusively depend on imported knowledge. Considerable research is being done by government agencies such as the Council for Scientific and Industrial Research, the Munitions Supply Laboratories and the universities. The same authority estimates that at least two hundred top-flight chemists are engaged on research projects at the tax payers' expense. Most of the results are made available to the Australian chemical industry free of charge.

While the chemical industry, like every other industrial group in Australia, kicks against government interference with free enterprise, it thus helps to encourage the paternalistic attitude of the Labor administration.

Excessive dependence on tariff protection and import restrictions is another manifestation of this slant on the duties of government.

Dr. Vernon must have had this situation in mind when he warned in his presidential address that unless the chemical industry "is prepared actively to plan and try to keep its costs down, a good many manufacturers may be in a shaky position before very long."

British Are Spending Big Sums on New Chemical Plant Construction

CHEMICAL production in Great Britain continues to increase slowly, and more substantial output is expected before the end of the year as more new plants and extensions are scheduled to reach the productive stage in the next few months. The continuing expansion however goes hand in hand with a process of consolidation which is reflected in various ways. Employment figures, for instance, are not rising parallel to output, and fuel consumption is also lagging behind. More men are put on payrolls, but fewer women stay in the factories. More oil and coal derivatives are being burnt, but coal consumption is not rising to the same extent. The purpose and effect of these changes—and there are similar tendencies in raw material consumption and plant utilization—is improved operational efficiency. More will be heard of the need for efficiency and economy in the future, and the additions to chemical plant capacity scheduled to be put into commission from now on should help to make an efficiency drive successful.

It is not perhaps realized clearly enough what vast expansion Britain's chemical industry proposes to carry through in the next few years. The leading chemical combine in the country has drawn up an expansion program involving the expenditure of £130,000,000—more than $500,000,000—in the next eight years; one of its new plants alone will cost £17,000,000. For comparison's sake it may be stated that in its last balance-sheet the company showed its fixed assets, at cost less obsolescence and depreciation, at £55,500,000; it thus proposes to spend more than twice the present value of all its existing lands, buildings, plant, machinery and equipment over the next eight years—and this is not an isolated case. The National Gas Council intends to invest £250,000,000 in new production and distribution facilities. This sum is equal to the compensation paid out to present gasworks owners for their possessions under the nationalization bill. In the next two years no less than £70,000,000 are to be spent on repair, reconstruction, modernization and maintenance of gasworks, distribution networks and—last not least—chemical by-product recovery and treatment plant.

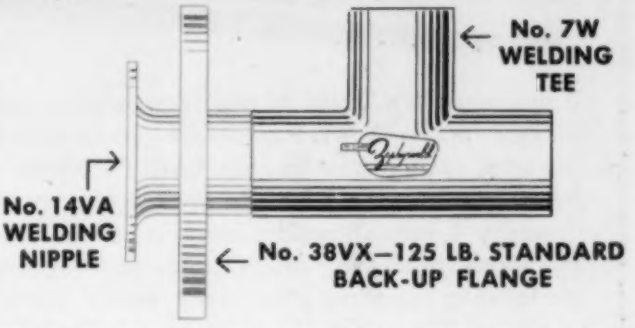
No other undertaking of chemical interest singly equals these large investment programs, but in proportion the new construction plans of other companies are no less ambitious. The oil refining industry will spend a total of £95,000,000 on new refining and cracking plant. The Anglo-Iranian Oil Co. has earmarked £30,000,000 for a new oil refinery at the

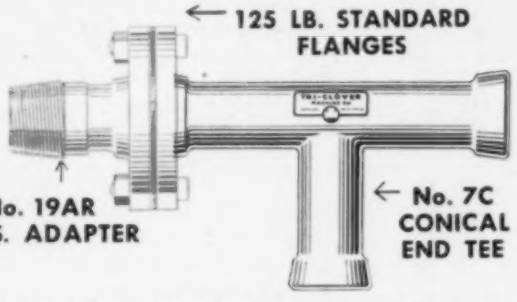
Tri-Clover STAINLESS STEEL O. D. Tube Size INDUSTRIAL FITTINGS

...easily assembled* with practically all other Fitting Types

*Using Zephyrweld WELDING FITTINGS...
(Stainless Steel Type 304—347—316)

It is a simple matter to adapt Tri-Clover Welding Fittings thru the use of tube size Welding Nipples . . . Slip-on, Socket Joint or Companion Flanges, or by using I. P. S. male or female adapters which assemble to tubing by simple expanding or butt welding. Sizes from 1" thru 24" (*outside* tubing diameter). *For complete details, send for Catalog 748.*



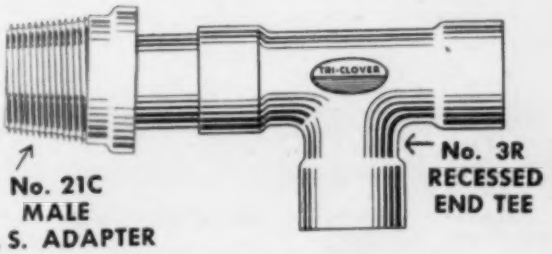


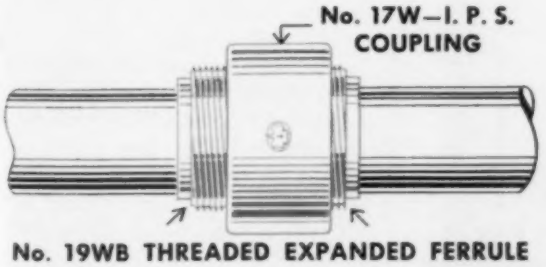
*Using Flanged Type CONICAL END FITTINGS...
(Stainless Steel Type 316)

Simple male and female I. P. S. adapters provide fast, easy assembly of Tri-Clover Conical End Fittings to threaded iron pipe size fittings and valves. For assembling to flanged fittings and valves, standard-dimension 125 lb. and 150 lb. flanges are available, which are bored to mate with the conical end fittings. Sizes from 1" thru 10" (*outside* tubing diameter). *For complete details, send for Catalog 847.*

*Using Recessed-End FITTINGS...
(Stainless Steel Type 304—347—316)

Employing standard methods of soft soldering, socket welding, or silver brazing, Tri-Clover Recessed-End Fittings can be quickly adapted to threaded iron pipe size fittings (male or female) through the use of simple adapters, as illustrated. Light gauge tubing end is cut square, inserted into recessed end of adapter, joined by any of the three simple assembly methods. I. D. of fitting matches O. D. of tubing. Sizes, 1" thru 10" (*outside* tubing diameter). *For complete details, send for Catalog 948.*





Using Wallace PIPE UNIONS...
(Stainless Steel Type 304—347—316)

This patented joint permits a rapid adaption of light gauge tubing to standard threaded valves, couplings, flanges and other fitting types. Tri-Clover Wallace Joints (threaded ferrules) are firmly attached to tube ends by expanding, butt welding, or pre-fabrication. Pressure tests prove unions are completely leak tight. Sizes from ¾" thru 4" I. P. S. *For complete details, send for Catalog 647.*

● TRI-CLOVER O. D. TUBE-SIZE FITTINGS SAVE UP TO 65% IN MATERIAL...without loss of strength. Due to the basic difference in weight between iron pipe size and light gauge tube size, the savings in "dead metal" will run as high as 65% when Tri-Clover Stainless Steel O. D. Industrial Fittings are used with tubing to form lightweight, low-cost, corrosion-resistant conveying lines. Tube bursting pressures (5,225 psi for 1½" tube) provide safety factors more than ample except for infrequent requirements for extremely high pressure. *See your Tri-Clover Jobber, or write for catalogs.*

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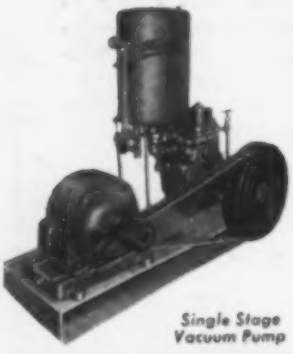
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10 MICRONS ▶

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Compound Vacuum Pump



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Two sizes of Compound Pumps are available in capacities of 15.2 or 46 cu. ft. per min., with 1 and 3 hp motors. The working mechanism is similar to the Single Stage but the two cylinders are connected in series. Air cooled casing of unique design has special provision for oil sealing and lubricating the working parts. Low absolute pressures to 0.5 micron (.0005 mm. Hg.) are regularly maintained.

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Thames Estuary and smaller extensions at existing refineries. Shell and Agwi Petroleum Corp. will spend somewhat smaller sums on petroleum refineries, situated on the Thames and on Southampton Water. National Oil Co. will expend £9,000,000 on trebling its refinery at Landarcy, near Swansea in South Wales. Thus Britain will soon possess four new modern refineries with throughout capacities of 3,000,000 to 4,000,000 long tons of crude oil each. At least two lubricating oil manufacturers are engaged in extensions, and other specialists are also embarking on expansion schemes to keep abreast of the increased by-product production and the growing demand for motor fuel additives.

The leading petroleum refiners have made their own arrangements for the chemical utilization of refinery by-products. Thus the Shell company has erected a chemical plant at Thornton where 50,000 tons of detergents are being produced annually, and is extending plants at Stanlow, on the Manchester Ship Canal, at Shell Haven, Essex, and elsewhere for the manufacture of sodium higher alkyl sulphates, synthetic soaps and cleansing agents, wetting agents, insecticides and fungicides. The Anglo-Iranian Co. has joined forces with Distillers Co. in a £5,000,000 company for the production of petroleum chemicals at Grangesmouth, Scotland, where the company is spending £7,000,000 on an extension of its oil refinery; five years are expected to elapse before this plant is in full operation.

New Chemical Enterprises

Closely linked with the expansion of petroleum refining are also the new enterprises launched by chemical companies who wish to enlarge the production of organic compounds. Most important of these is the Imperial Chemical Industries plant now in course of erection at Wilton, opposite Billingham, on Teeside. It is this plant, which will cooperate closely with the Billingham works, which is estimated to cost £17,000,000 to erect and equip. The first plant section will reach production before the end of the year. Of considerable interest is the plant which Petrochemicals Ltd. is building at Partington, on the Manchester Ship Canal. Part of this plant will come into operation this year. Delays in the delivery of machinery have given the company an opportunity to revise earlier plans, with the result that the effective capacity will be 30-50 per cent above the original estimate of 50,000 tons of various petroleum-derived chemicals. Delays and increases in ma-

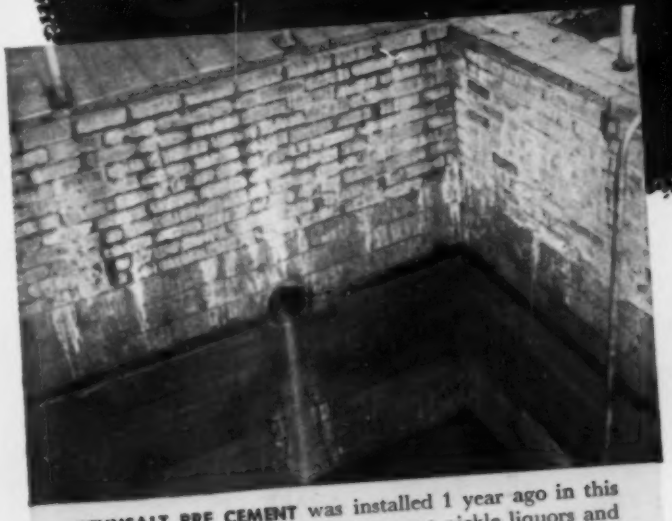


PENCHLOR® ACID-PROOF CEMENT bonds the acid-proof brick on this industrial floor which has never needed repair in 14 years of attack by H_2SO_4. Penchlor is one of Pennsalt's silicate type cements . . . chemical-setting, quick-hardening, thorough-curing . . . designed to resist a wide variety of acids.



PENNSALT CAUSPLIT® CEMENT was used in this tile lining to resist attack from acids and alkalies alternately. Causplit Cement is resistant to alkaline conditions and will also resist many acids.

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PENNSALT PRF CEMENT was installed 1 year ago in this industrial waste tank handling spent pickle liquors and alkaline cleaner solutions, and the joints are still in excellent condition. PRF Cement is a resin-type, quick-setting, cold-hardening cement designed to resist most alkalies, acids and solvents.



PENNSALT ASPLIT® CEMENT bonds the acid-proof brick in this continuous pickling tank, operating at 210°F. Built 8 years ago, the joints are still free from attack. Asplit Cement is a self-hardening resin cement of unusual strength and toughness, and high resistance to a wide variety of acids.

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CORROSION-RESISTANT CEMENTS
of many types for Acids, Alkalies, Solvents

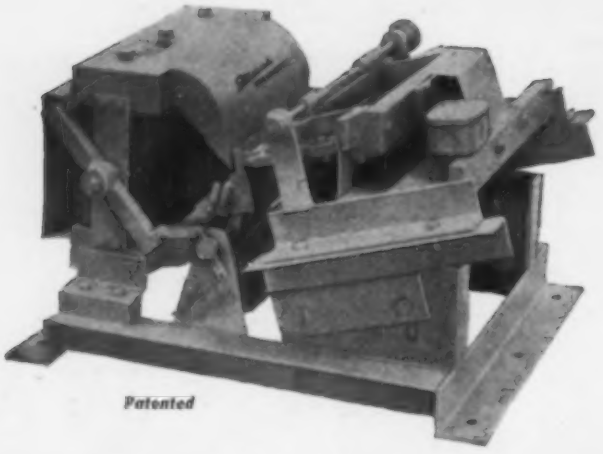
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chinery prices combined with this revision have however doubled the prospective cost of the plant, so that the company has had to raise another £2,500,000 of capital. Plant for the manufacture of detergents from a mineral oil basis has also been erected by the Manchester Oil Refinery Ltd.

Synthetics

In the plastics field B. X. Plastics Ltd. started the production of polyvinyl chloride in a factory at Dundee last year; its production there was to be raised. In the meantime the British Geon Ltd., in which Distillers Co. is cooperating with B. F. Goodrich Chemical Co., has commenced the production of the material. Distillers Co. hopes to develop the production of a wide range of synthetic resins, adhesives, molding powders and compounds through the British Geon Ltd. and another subsidiary, British Resin Products Ltd., at Barry, South Wales. For the extensions here the sum of £2,000,000 has been earmarked. A similar amount is being spent by another Distillers subsidiary, British Industrial Solvents Ltd. for extensions of manufacturing facilities for solvents, plasticizers, acetic acid and anhydride at Hull. The Dunlop rubber group has also taken a hand in this field through the Dunlop Special Products Ltd. Bakelite Ltd. is planning a development program involving a total expenditure in excess of £2,000,000. British Xylonite Ltd. is building a new factory at Bexford, and the B.X. Plastics Ltd. will start the production of synthetic camphor this autumn. In this connection its capital has been raised by £200,000 to £1,000,000. Synthite Ltd. is making preparations for the erection of a new formaldehyde factory at Mold, North Wales, and the new plant which Erinoid Ltd. is building for Congo copals at Stroud is nearing completion.

Leading paint manufacturers have also shown considerable interest in synthetic resins and other organic compounds which may help them to solve their oilseed supply problem. One of them has arranged with Petrochemicals Ltd. for the production of indene resins. Another one, British Paints (Holdings) Ltd. has opened its own synthetic resin plant at Dunston-on-Tyne. Lewis Berger & Sons Ltd. has erected a largescale plant for styrene, Pentaerythritol, made by I.C.I. at Powfoot, Dumfriesshire, is used extensively as a glycerine substitute, and modified glycerol and pentaerythritol esters for use in the paint industry are also to be made in a new Erinoid factory. Britain's biggest paint manufacturers, Pinchin John-







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son and Associates Ltd. have issued £1,000,000 of new shares to finance plant extensions. In general however expansion in the paint industry has been comparatively slow, largely because of the low rate of house building and restrictions on repair work which tend to keep the demand for paints below the pre-war level. Several firms however are installing new titanium oxide plant; for this purpose British Titan Products Ltd. has had to issue £1,250,000 of new shares.

Pharmaceuticals

Substantial funds have also been required for the erection of penicillin and streptomycin plant. Several firms have engaged in this new branch of the pharmaceutical industry. The biggest of these, Distillers Co. (Biochemicals) Ltd., was formed only last year; it is to raise its capital eventually to £1,000,000. Production facilities for other drugs and medicinal products however are also been extended, but as consumption is naturally limited expansion in this field is comparatively unimportant.

If little is heard of extensions to existing plants for the production of general inorganic chemicals, the reason is not that these extensions are insignificant but that they are carried out mostly by established producers through enlargement of existing works. Unfortunately few of these extensions are likely to be completed this year. Special attention has been paid of late to providing manufacturing facilities for imported chemicals to reduce the drain on the country's foreign currency reserves. A carbon factory is being erected at Hayes, Middlesex, by Powell Duffryn Carbon Products Ltd., a company with £1,500,000 capital. Acetate slab needed for the manufacture of sensitized film base is to be made in a British factory. Several firms propose to make oil additives. The production of petroleum chemicals and synthetic resins of course also aims at cutting down imports. Several British firms with U. S. connections are specializing in the manufacture of chemicals in Britain for which the authorities are unwilling to grant import licenses.

It is significant that hardly a chemical firm of any importance is absent from the long list of new plant and extension projects and that many of these involve the expenditure of sums equalling and indeed surpassing the total of the firms' present fixed assets. This is no doubt partly due to wartime omission of normal replacement and extension and to the greatly increased importance of the chemical industry, especially its organic branch, in the British economy.

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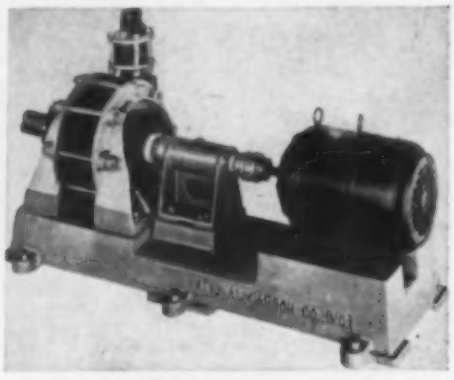
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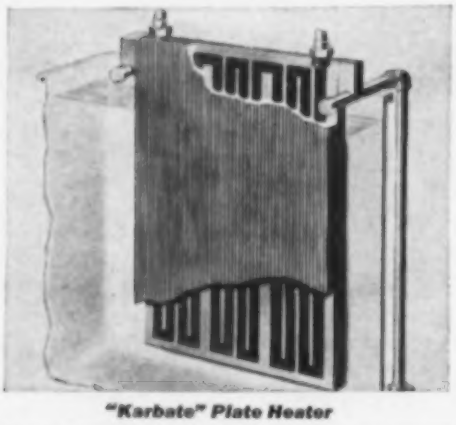
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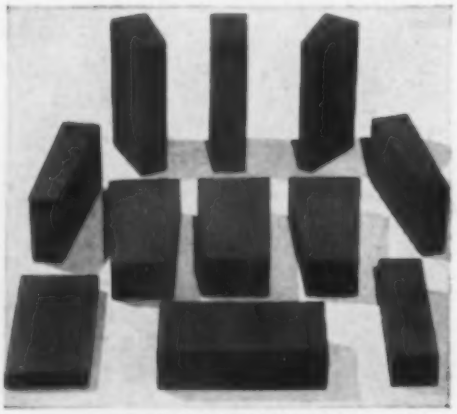
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"National" carbon brick is now extensively used for lining tanks that handle corrosive solutions — particularly nitric-hydrofluoric.

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THE CORROSION FORUM

Edmond C. Feller, ASSISTANT EDITOR



Sulphuric Acid versus Construction Materials

Part IV of a four-part symposium in which typical materials of construction are evaluated for services involving sulphuric acid.

LEAD'S BIGGEST USE in connection with sulphuric acid, the chamber process, is exemplified in these two Mills-Packard chambers (only upper third is visible).

CHEMICAL STONEWARE

F. E. HERSTEIN
General Ceramics and Steatite Co.
Keasbey, N. J.

SULPHURIC acid, in all concentrations, does not attack chemical stoneware. Therefore, this material of construction can be used both in the handling and in the manufacture under all conditions where stoneware is normally used.

Chemical stoneware fluid flow equipment such as piping, valves and pumps are quite commonly used for sulphuric acid solutions of all concentrations and are particularly used for dilute solutions because it is difficult to get metallic materials which will withstand an entire range of dilutions of sulphuric acid. Other process equipment such as storage vessels, towers, and reaction vessels are also commonly used for handling all concentrations of sulphuric acid where temperature and pressure conditions permit. Where the sulphuric acid is mixed with muriatic or nitric acid, chemical stoneware is particularly suited because these other acids also do not attack chemical stoneware.

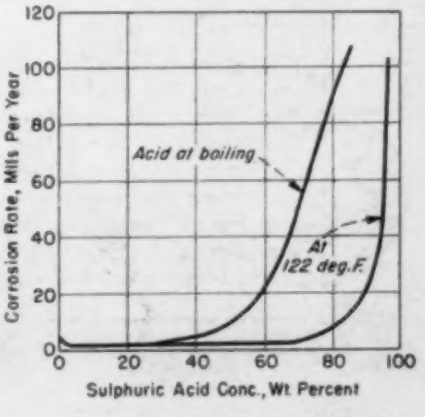
One particular application of chemical stoneware in the handling of sulphuric is in hydrogen peroxide manufacture, where towers, cells and piping of this material of construction are commonly used.

To sum up, as far as corrosion resistance is concerned, chemical stoneware is well suited for the handling of sulphuric and its applications are limited only by the fact that in some cases and at some concentrations metals can be substituted, and by the ordinary limitations of temperature, pressure and fragility which govern the use of ceramic materials of construction.

LEAD

KEMPTON H. ROLL
Lead Industries Assn.
New York, N. Y.

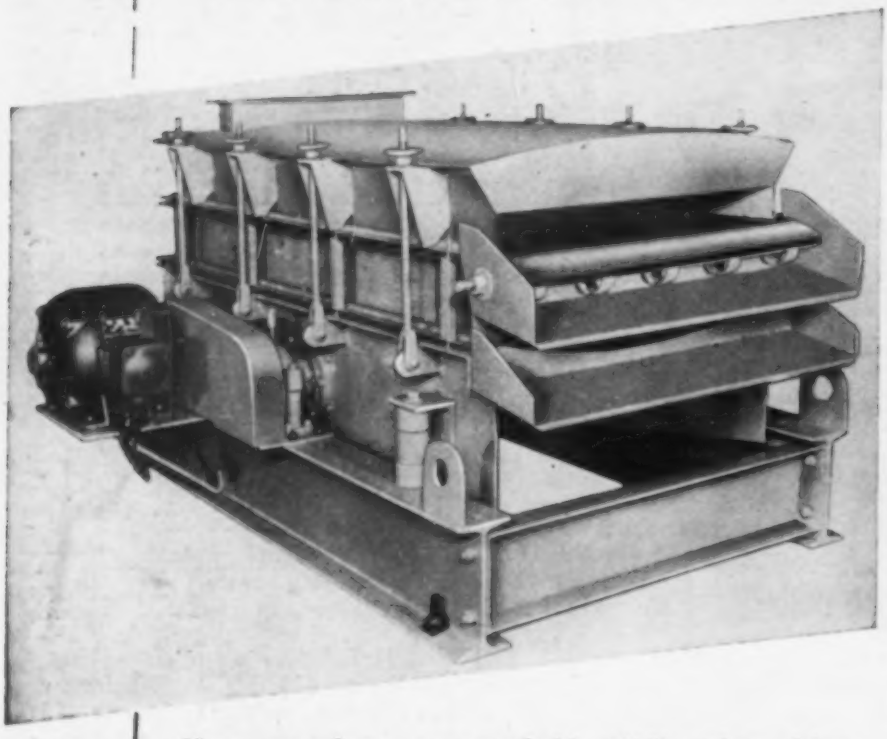
SULPHURIC acid is lead's forte, providing by far the bulk of its applications as a construction material in the chemical industry. Lead's resistance to dilute acid, in fact to all but concentrated acid, is probably known to more people than any other metal-versus-acid combination. At room temperature it resists all concentrations up to 96 percent; it resists 85 percent acid up to 425 deg. F. Satisfactory use is sometimes obtained up to 480 deg. F. The graph shows the corrosion resistance of lead to sulphuric at 122 deg. F. and at the boiling point. In obtaining data for this graph specimens were removed daily for 14 days and the protective sulphate coating dissolved in an acidified ammonium acetate solution (5 percent, hot). The corrosion rates are consequently maximum for total immersion in sulphuric acid. Although these values



From "Corrosion Handbook," John Wiley & Sons

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are excessively high, they serve as a guide for commercial practice.

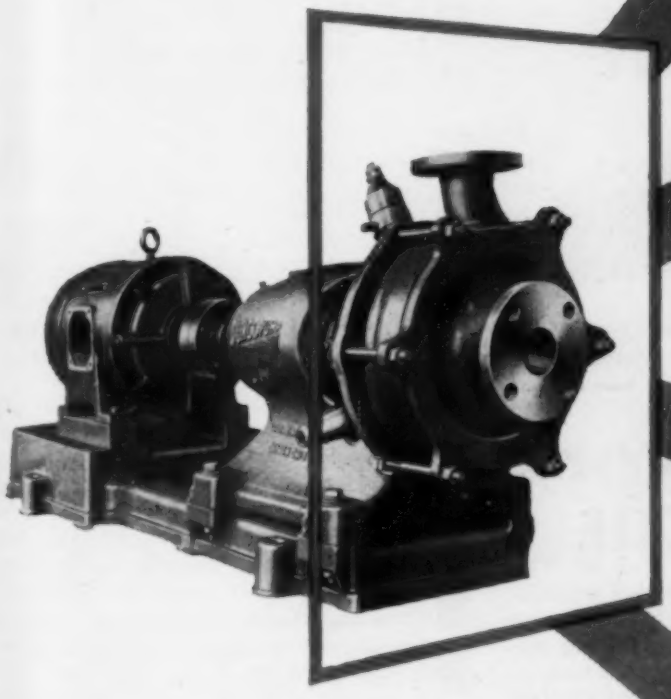
Since lead's resistance to sulphuric acid is due to a sulphate film it follows that high velocities or excessive turbulence can increase the rate of corrosion by removing the film. In pipelines this may be remedied by redesigning to reduce flowrates. In the table below the corrosion rate appears to fall as velocity increases but increases markedly at a velocity of 300 fpm. (Data are for 20 percent acid at 75 deg. F.)

Velocity of Solution, Fpm.	Corrosion Rate, Mils Per Yr.
8.4	6.6
97	2.0
155	1.9
300	10.3

The biggest use for lead in connection with sulphuric acid is in the manufacture of the acid, especially by the chamber process. From the introduction to the Glover tower the entire chamber process takes place within a series of chamber towers and ducts constructed entirely of sheet lead with supporting structures of wood, steel, brick or concrete. (When in direct contact with "green" concrete, lead should be protected by asphaltum or tar paper.) Lead pipe is used in handling the dilute sulphuric acid product. Most of the lead chamber plants throughout industry can show great length of service of sheet lead in use with the constituents of sulphuric acid in their most corrosive condition, hot and moist. Some old box type chambers were examined and it was found that virtually no corrosion had taken place after some 30 to 50 years in contact with the acid. The newer Mills-Packard chambers, which are shaped like truncaded cones (see photo), are cooled by water flowing down the sloping sheet lead sides; cooling the lead in this manner results in still longer life for the lead chambers even though interior temperatures are comparatively high.

Lead's importance in the manufacture of sulphuric acid by the contact process is not as great as in the chamber process because the concentration of the acids are higher and the temperatures generally exceed those at which lead may be used. However, the processing of hot, corrosive gas mixture from sulphide ore roasters prior to conversion to sulphuric acid is carried out in equipment fabricated from sheet lead with external steel supports. In a typical byproduct acid plant using the contact process large 40 and 50 ft. settlers, as well as a sulphur dioxide scrubber and cooler, are protected by lead against a sulphuric acid coolant solution; there has been no appreciable action on the lead in nine years. For over 15 months the

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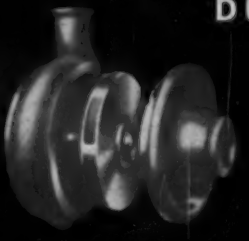
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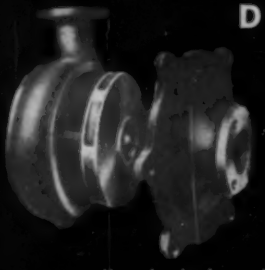
a high-silicon iron, containing approximately 14.5% silicon. Handles almost any commercial corrosive. Practically unaffected by sulfuric, nitric and acetic acid at any strength or temperature. Ask for bulletins 11 and 810.

DURICHLOR



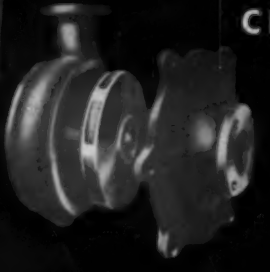
a high-silicon iron similar to Duriron but with much greater resistance to hydrochloric acid and its compounds, especially at higher temperatures and concentrations. Ask for bulletins 50 and 810.

DURIMET



a high nickel—high chromium—molybdenum—copper—silicon—low carbon stainless steel. Some of the corrosives it successfully handles include sulfuric and sulfurous acid, oleum, caustic and bleach solutions. Ask for bulletins 110-2 and 811.

CHLORIMET



2—nickel base, high molybdenum alloy; # 3—nickel base, high molybdenum, high chromium alloy. Both of these are high strength, machinable alloys. Chlorimet # 2 handles hydrochloric acid in all concentrations and temperatures. It is excellent for hot sulfuric acid under reducing conditions and for wet hydrogen chloride gas. Chlorimet # 3 handles most acids under oxidizing conditions, various salt solutions, also hot sulfuric in concentrations of less than 35%. Ask for bulletins 111 and 811.

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coolant in this particular installation contained, in addition to 56 g. per l. of sulphuric acid, 1.5 g. per l. of fluorine with still no apparent effect on the lead linings and equipment. Other lead lined apparatus—ducts, pipes, valves and pumps—have given at least 16 yr. service handling roaster and sulphuric acid gases and solutions at various temperatures. Similar longevity is recorded for the lead pipes in the plant's Cottrells; these are the pipes on which dilute sulphuric acid is electrostatically precipitated; temperature ranges from 77 to 104 deg. F.

Outside the manufacture of sulphuric acid, the uses for lead in handling the acid are legion—almost as varied as applications of the acid itself. Lead sheet $\frac{1}{16}$ to $\frac{1}{4}$ in. thick is used to line vacuum concentrators where dilute sulphuric acid, as from oil refineries or rayon plants, is concentrated to 95 percent; in these concentrators a heavy inner lining of acid brick protects the lead from distortion by thermal fluctuation. Lead linings, and often lead steam coils, are found in the metallurgical industry's treating tanks where sulphuric acid is used to pickle steel or clean brass, bronze or copper. Lead linings are used in the tanks where alum is made by the reaction of strong sulphuric acid on alumina; because heating is cyclic and goes as high as 260 deg. F. this is one of lead's severest applications and great care must be exercised in strapping and other design to resist distortion. Lead covered equipment is used to make aluminum sulphate for bead catalyst manufacture; in this application it is significant that soluble corrosion products would ruin the catalyst.

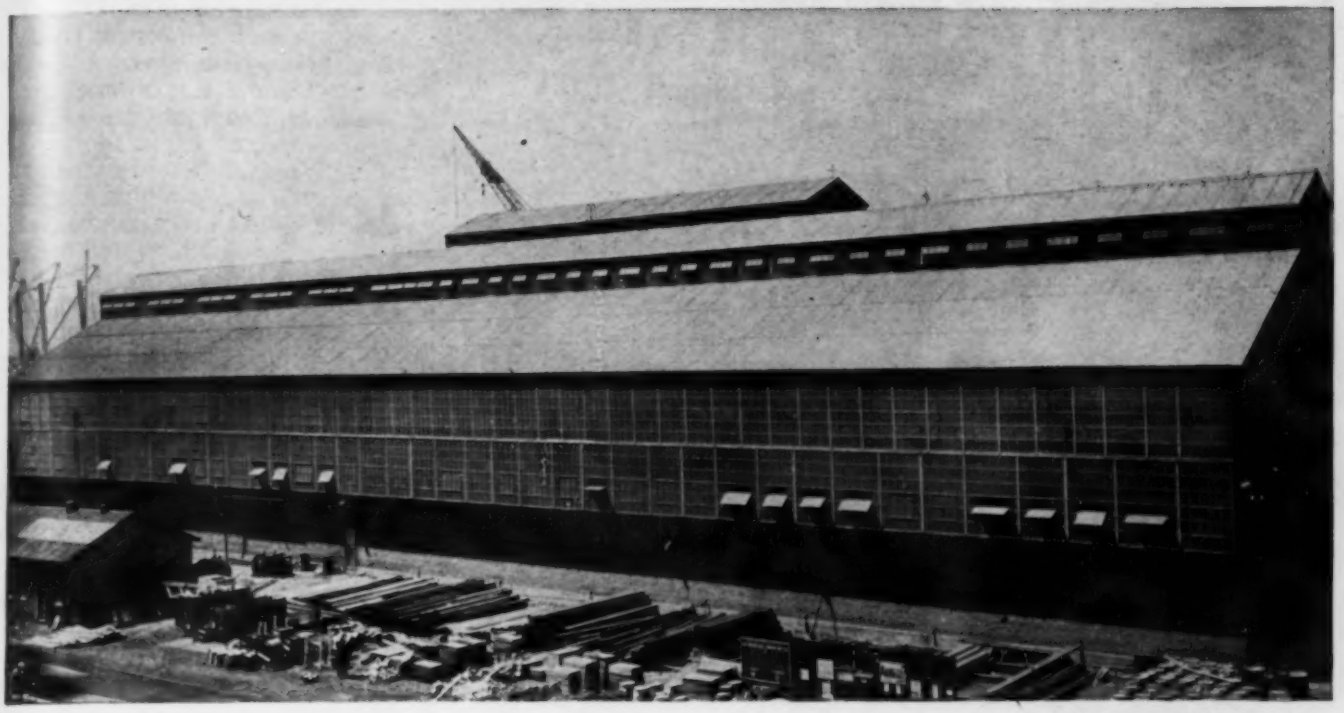
Sheet lead is available in any thickness from 1/80 in. to 2 in., or, in lead parlance, from $\frac{3}{4}$ lb. to 120 lb. (This method of indicating thickness by weight is peculiar to the lead industry; as an approximate rule of thumb, one square food of lead $\frac{1}{16}$ in. thick weighs about one pound and is called 1-lb. lead). Thinner sheet or foil is not employed in the chemical industry and the bulk for the chemical industry ranges from 6 to 20 lb.

Homogeneous lead linings (lead actually bonded to shell) are used when there are frequent and wide temperature variations, or when efficient heat transfer is necessary, or sometimes when tanks are under internal vacuum.

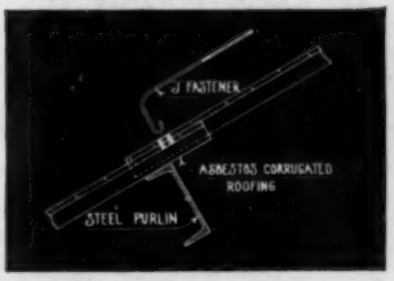
Acid brick inner linings are used when temperatures are in the softening range of lead, or when temperatures fluctuate over a wide range in a short time, or when severe physical abrasion is present.

Hard lead, containing an average

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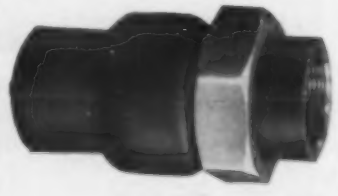
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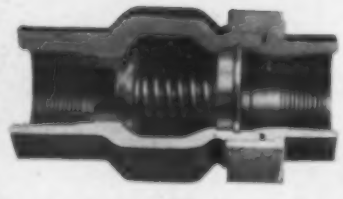
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of 6 percent antimony, is used when greater rigidity than chemical lead is desired, provided concentrations are lower, stresses are less than 50 psi. and temperatures less than 240 deg. F. Above 240 hard lead softens rapidly, corrodes more readily and is considerably less effective than chemical lead.

Tellurium lead is used where higher fatigue properties are required.

Lead is frequently used for protecting apparatus such as stirrers and mixers for use in sulphuric acid solutions. Ordinary lead-sheathed steel generally suffices. However, when abrasion is encountered, antimonial lead may be cast with hard grains of aloxite embedded in the surface; this product is known as "plumbalun." Pipes and pumps for sulphuric acid are frequently made of steel and cast iron with a lead lining hydraulically expanded against the pipe or homogeneously bonded to it. Some valves are made entirely from cast lead. Antimonial lead is generally used in pumps and valves because it is stronger and resists flow abrasion better than chemical lead.

CHLORIMETS

WALTER A. LUCE
The Duriron Co.
Dayton, Ohio

EXTENSIVE laboratory and field tests conducted on the Chlorimet 2 and Chlorimet 3 alloys indicate that they can be applied successfully to most of the severe sulphuric acid services encountered in chemical plant processes. By severe service is meant high temperature, and/or the presence of many corrosive constituents as contaminates, which prove excessively corrosive to other type alloys.

Chlorimet 2 is a high nickel-molybdenum alloy with a nominal chemical composition of 63 percent Ni, 32 Mo, 3 Fe max., and 0.10 C. Chlorimet 3 is also a nickel base, high alloy with a nominal chemical composition of 60 Ni, 18 Mo, 18 Cr, 3 Fe max., and 0.07 C max. Both of these alloys are produced in the cast form only and are machinable. At present, production is limited to pumps and valves. As a general rule, Chlorimet 2 should be used under reducing conditions and the chromium bearing Chlorimet 3 under oxidizing conditions.

The curves indicate graphically the chemical resistance of the Chlorimet alloys to various concentrations of sulphuric acid at 176 deg. F. and at the boiling temperatures. The data for these figures were obtained from laboratory corrosion tests; and although laboratory corrosion testing is not highly indicative of actual corrosion under operating conditions, it



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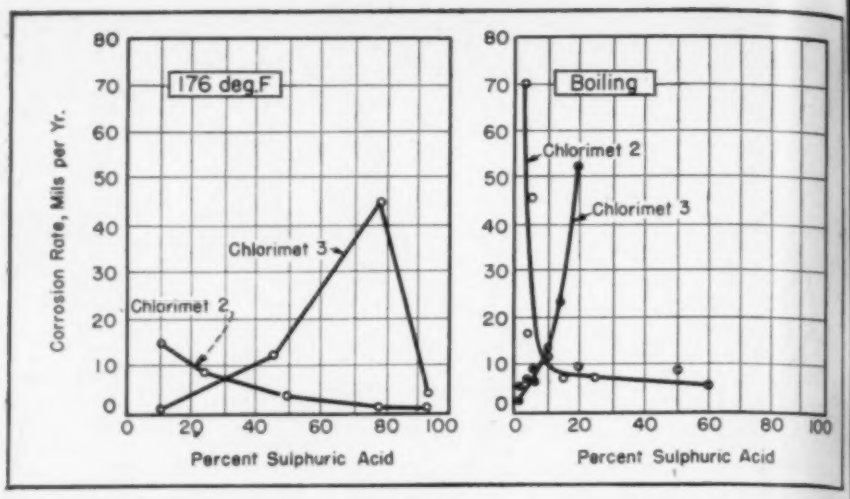
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Chlorimets 2 and 3 compliment each other in sulphuric acid resistance. At both temperatures Chlorimet 3 takes the lower concentrations, Chlorimet 2 the higher.

corrosion will follow. Chlorimet 2 is usually recommended in preference to Chlorimet 3 for sulphuric acid strengths above 35 percent at 176 deg. F., and from 10-60 percent at the various boiling temperatures. Chlorimet 3 is the better alloy for acid concentrations below 35 percent at 176 deg. F. and below 10 percent at boiling temperatures.

The high alloy stainless steel, Durimet 20, can be applied successfully in many cases where the Chlorimet 3 alloy is recommendable if a lower priced alloy is desired and a somewhat higher corrosion rate can be tolerated. However, the effect of additional constituents as contaminants in the solution sometimes favor the Chlorimet 3 alloy over Durimet 20.

A number of actual plant solutions which have been resisted successfully by the Chlorimet alloys will be cited below. As is usually the case, it was necessary to resort to the Chlorimet alloys when other alloys failed to

TANKS
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SPECIFICATIONS



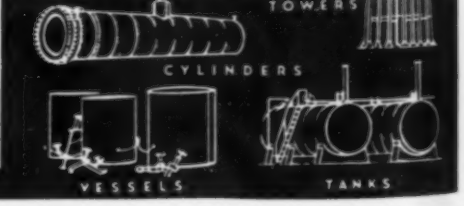


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tions, or when only an exceedingly low amount of corrosion was tolerable.

(1) Chlorimet 2 shows good resistance in handling a reactor dump solution at 240-250 deg. F. The dump solution was composed of 28 percent sulphuric acid, 28 percent sodium sulphate, 3 percent sodium chloride, a small amount of methyl alcohol and 30 percent water. (2) Chlorimet 3 shows excellent resistance to a scrubber solution consisting of a mixture of sulphuric acid, hydrochloric acid, nitric acid, selenous acid, and sodium chloride at 140-150 deg. F. (3) Long period tests of Chlorimet 3 in a rayon spin bath acid solution at a high temperature showed negligible corrosion. (4) Chlorimet 3 is giving excellent service on fatty acids sulphonated with dilute sulphuric acid. Temperatures reach 175 deg. F. (5) Both Chlorimet 2 and Chlorimet 3 prove highly resistant to a 56 deg. Be. sulphuric saturated with Cl.

PROTECTIVE COATINGS*

DILUTE sulphuric acid is not so hard on protective coatings, in general, as are dilute nitric acid or dilute muriatic acid. Concentrated sulphuric acid attacks many organic materials. A few of the plastics that are used in protective coatings, like polyvinyl chloride, polystyrene and polyvinylidine chloride, are quite resistant to concentrated sulphuric acid. Laboratory tests of proprietary protective coatings have indicated considerable variation among those that are reported as acid resistant (see table). These protective coatings were all air dried with six or seven coats and were tested in 98 percent sulphuric acid at room temperature.

Following is the text of a private communication to the author from F. L. Sharpe, Jr., of the General Coating Co., Woodbridge, N. J., marketers of Heresite coatings:

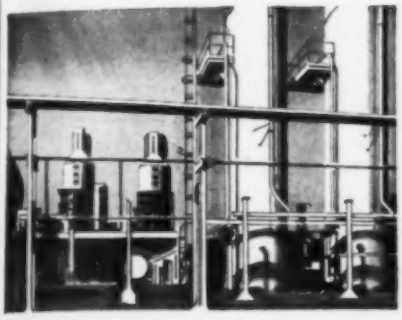
"All Heresite coatings, both baked and airdry, are resistant to sulphuric acid solutions and fumes. The following data apply to sulphuric acid solutions: (a) Heresite baked phenolic industrial coating will stand up to 35 percent concentration sulphuric acid solutions at any temperature up to and including boiling. For concentrations over 35 percent the maximum operating temperature is approximately 150 deg. F. (b) Heresite airdry coatings, both vinyl and phenolic base, also will withstand both dilute and concentrated solutions of sulphuric acid at room temperatures. The maximum operating temperatures

* The author of this article is with a large chemical company which uses but does not produce protective coatings.

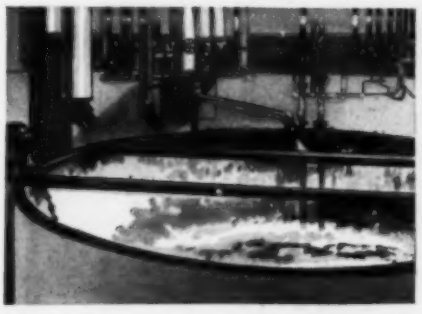
Are Your Corrosion Problems As Severe As These?



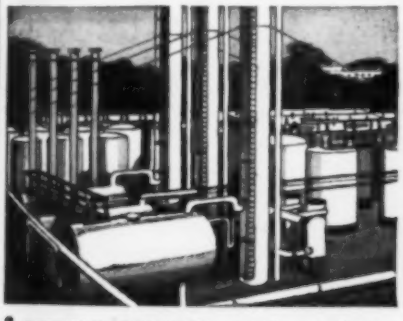
You won't be discouraged by any corrosion problem, when you read how these four companies have finally controlled extremely severe corrosion in their plants with a system of UCILON Protective Coatings!



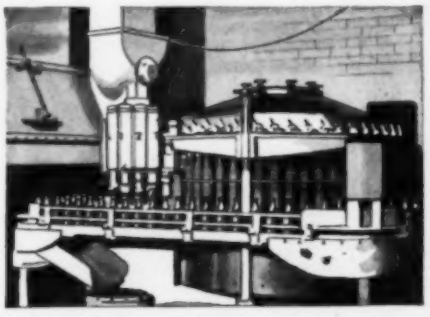
1. A WELL KNOWN REFINERY had Ucilon coatings applied to ducts exhausting oil and gasoline fumes at the cracking tower. One year after application, there was still not a sign of failure, despite the severity of the service.



2. A SOAP PLANT had a tough ceiling maintenance problem—some ordinary paints being destroyed by fatty acid vapors in as little as 2 weeks. Yet after *6 months* of exposure, Ucilon coatings were still totally unaffected!



3. A CHEMICAL PROCESSOR coated a steel storage tank with a Ucilon coating system. Especially hard on protective coatings, the tank's contents broke down two other coatings tried—one in 6 weeks. Yet Ucilon is still in good condition after *14 months!*



4. IN THE BOTTLING ROOM of one company, painting of machines was considered to be almost useless—until they discovered Ucilon. Nothing ever tried even approaches the effectiveness of Ucilon, which for *2 years* has been withstanding the humidity and spillage!



UCILON* 400

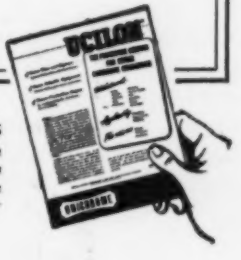
Ucilon 400 is a flexible, glossy, air-drying coating for metal, concrete and wood. It is applied by brushing or spraying. When solvents evaporate, a tough "plastic" film is formed. Ucilon 400 provides exceptional resistance to acids, alkalies, alcohols, oils and greases, salts, water, cleaning compounds, oxidizing agents.

OTHER UCILON COATINGS

Ucilon 1601—a ready-mixed, extra-bright aluminum paint with exceptional outdoor resistance. It stays bright under prolonged exposure, withstands elevated temperatures.

•

Ucilon 1501—a very hard, chip-resistant baking coating which resists chemical attack at temperatures higher than recommended for Ucilon 400.



SEND FOR THIS BULLETIN *which gives more details on various Ucilon coatings and their properties.*

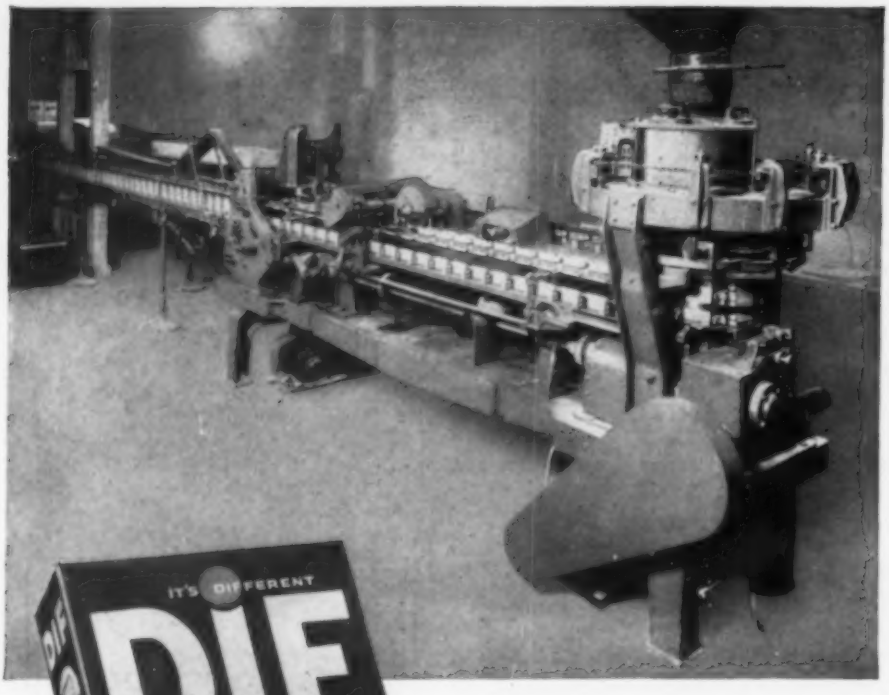
Similar reports continue to arrive from plants of every nature. Maintenance men are discovering a degree of corrosion protection and service life they never achieved with any coating tried before. If *you* have an exceptionally tough coating problem, we're confident that there's a Ucilon coating system to help you stop corrosion damage and vastly lengthen the period between your paint jobs. Let us send you our specific recommendations without obligation. Write today, outlining the details of your application.

*Trade Mark Reg. U. S. Pat. Off.

UCILON Protective Coatings

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Protection of Steel Panels in 98 Percent Sulphuric Acid at Room Temperature

Coating Tested	Days Protection by Coating
Prufcoat, Prufcoat Labs	3, 3,* 5,* 6, 8, 8, 8,* 14
Sovaklor Grey, Socony Paint Prods	8
Sovaklor White, Socony Paint Prods	7
Cocoon, R. M. Hollingshead Co	6
Corrosite, Baker Synthetics, Inc	1, 2, 4
Stayson, Stayson Finishes	3
Koralon, Tycor Prods., Inc	2
Tygon, U. S. Stoneware	1, 2
Fedelco, Federal Electric Co	2
Neolac, Chamberlain Eng. Co	1, 2
Penkote, Peninsular Chem. Prods	1, 1
Rubber Coat, Wilbur & Williams Corp	1
Valdura, Amer. Marietta Co	1
Nukemite, Nukem Prods. Corp	1
Sanco, Munroe Sander Corp	No protection
Kromall, Munroe Sander Corp	No protection
Garland, Garland Co	No protection

More than one number after a coating means the coating was tested more than once; each number is for a separate test.
* Other coatings in this test made it necessary to stop before Prufcoat had failed.

for the airdry coatings in solutions is 130-140 deg. F.

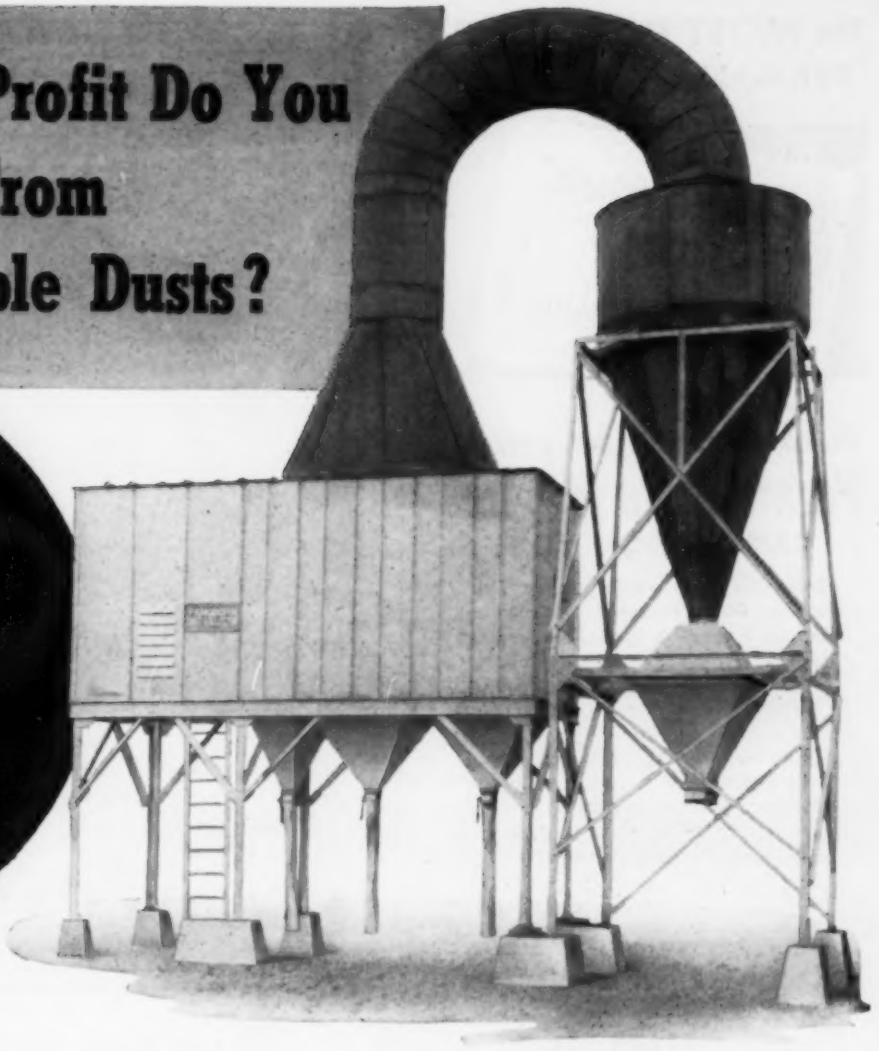
"Relative to resistance to sulphuric acid fumes, the following data applies: (a) The Heresite baked phenolic industrial coating will withstand sulphuric acid fumes up to a concentration of 250,000 ppm. at a maximum operating temperature of 175 deg. F. Further, this coating will withstand sulphurous acid fumes of any concentration up to 100 percent at a maximum temperature of 212 deg. F. (b) The vinyl base airdry coatings will withstand both sulphuric and sulphurous acid fumes up to a concentration of 250,000 ppm. at a maximum temperature of 140 deg. F. (c) The phenolic base airdry coatings will withstand the same fume concentrations as the vinyl base. However, the maximum temperature is 86 deg. F.

"In general, the baked phenolic coating is recommended for sulphuric acid applications since it has the necessary corrosion resistance at the noted conditions, can withstand higher temperatures than airdry coatings, and further, due to its much harder surface, has much better abrasion and erosion resistance, which is reflected in a longer service life. Airdry coatings can be recommended for solution and fume temperatures as noted above and when abrasion and erosion factors are not present.

"These coatings have been successful on many types of equipment exposed to sulphuric acid corrosion. For example: rayon spinning buckets, bobbins, traverse bars; textile machine rolls; process and storage tanks; tank cars and truck tanks; piping and fittings (flanged); fans and blowers; filtering equipment, press plates and frames; fume exhaust systems; dryer pans; steaming traps; centrifuge baskets and housings; agitators;

"Airdry coatings are also used on equipment and machine parts which

How Much Profit Do You Lose From Salvageable Dusts?



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HERE'S proof . . . actual cases of dust salvage profits quoted by enthusiastic Pangborn users . . .

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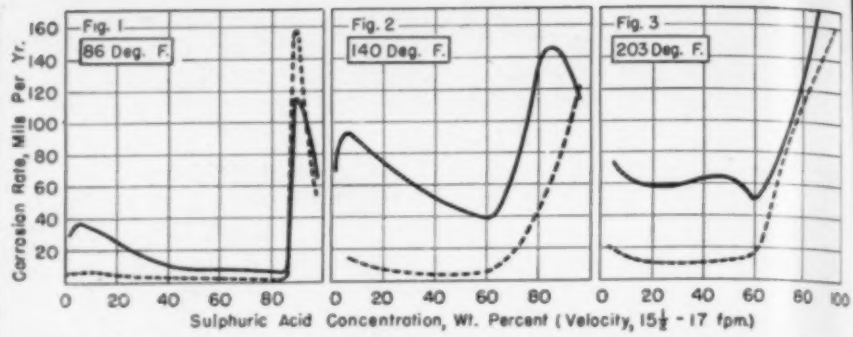
- Tremendous Power
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Monel vs. sulphuric acid. Solid lines for air sat.; dotted for air free (N_2 sat.).

are exposed to corrosive fumes and spillage and serves as an excellent maintenance coating.

"Regarding application, surface preparation by means of sand-blasting or acid-etching is recommended where resistance to severe corrosive conditions is required. Further, a multiple coat application resulting in a 0.004 to 0.006 in. coating thickness is required for sulphuric acid resistance."

NICKEL, NICKEL ALLOYS

W. Z. FRIEND
International Nickel Co.
New York, N. Y.

MONEL is commonly used for handling sulphuric acid solutions under essentially reducing conditions and at moderate velocities. Corrosion rates are considerably increased by a high degree of aeration or the presence in the acid of oxidizing salts such as ferric, cupric, or mercuric sulphates or of chromates or nitrates. The results of laboratory corrosion tests of Monel in air-free and air-saturated sulphuric acid solutions at 86 deg. F. are shown by the curves in Fig. 1. Corrosion rates at 140 deg. F. are shown in Fig. 2, and at 203 deg. F. in Fig. 3. These tests were of 48 hr. duration with specimens moved at velocities of 15.5 to 17 fpm.

In unaerated solutions Monel usually has suitable resistance in concentrations up to 85 percent at atmospheric temperature and up to about 60 percent at temperatures up to about 200 deg. F. In boiling solu-

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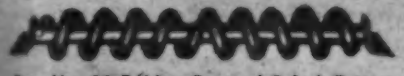
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DEPENDABILITY



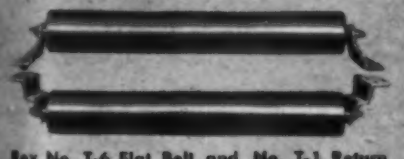
A FEW OF THE REX IDLER LINE



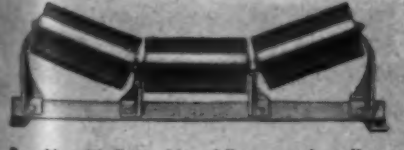
Rex No. 35 Rubber-Covered Spiral Return Idler . . . creates an ever-changing point of contact to keep moisture, ice, abrasive and sticky materials from building up on the belt.



Rex No. 33 Self-Aligning Troughing Idler . . . used at intervals to align belt where off-center loading, side-wind drifting and uneven stretch are problems.



Rex No. T-6 Flat Belt and No. T-1 Return Idlers . . . are dead shaft type idlers. They are equipped for high pressure grease lubrication . . . have hydraulic type fittings.



Rex No. 32 Troughing Idler . . . is roller-bearing equipped, can be furnished with steel or gray iron rolls. Has no shelves or pockets to catch dust . . . is self-cleaning.

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Here's a real "life saver" for your conveyor belts! Rex Impact Cushioning Idlers installed under the loading points will take the "bumps" for your belt . . . minimize ruptures and lacerations!

Rex Impact Cushioning Idlers are dual-purpose rubber rolls. These rolls are scientifically molded with (1) deep primary grooves for maximum cushioning . . . and (2) secondary grooves to provide surface softness to protect belt covers from laceration.

Here's deflection under impact! When otherwise damaging blows occur, there is momentary displacement of the rubber that absorbs the shock and cushions the impact force . . . and saves the life of your belt! There's plenty of support for Rex Impact Cushioning Idlers, too . . . heavy, unbreakable brackets on a steel channel base.

Rex Impact Cushioning Idler Rolls are pressed to the Rex Roller Bearing Assembly Tubes . . . the famous tube design that has been leading the field for over twenty-five years . . . with thousands of long-lived applications in almost every industry. For all the facts about these "life saving," belt saving idlers . . . write for Bulletin No. 463. Address Chain Belt Company, 1648 West Bruce Street, Milwaukee 4, Wisconsin.

CHAIN BELT COMPANY REX BELT CONVEYOR IDLERS



and still a GOOD DIP

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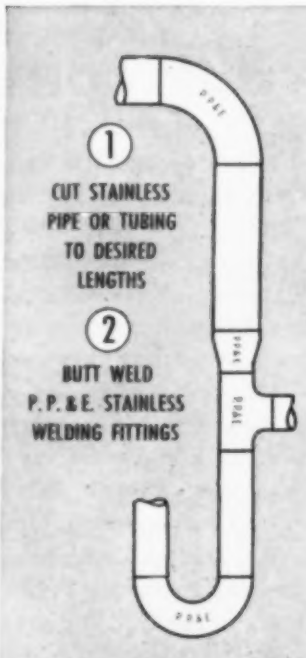
WIRE PRODUCTS Jelliff SINCE 1860

Table I—Laboratory Corrosion Tests of Nickel and Inconel in Sulphuric Acid

Conc., Wt. % H_2SO_4	Temp., Deg. F.	Duration, Hr.	Corrosion Rate, Mils per Yr. Nickel		Inconel	
			Unaerated	Aerated	Unaerated	Aerated
2	70	5	...	...	...	...
5	86	24	9	61	9	73
5	140	100	10	88	10	...
5	176	20	30	200	30	150
10	70	96	2	...	4	...
10	170	120	12	...	...	...
10	176	6	...	120	...	...
20	70	5	4	...	...	...
25	180	20	...	...	...	83
50	86	24	...	16	...	...
50	158	...	18	...	...	...
70	100	24	...	10	...	...
70	86	20	...	...	46	...
93	86	20	...	10	270	10
93	149	...	146	...	...	...

tions it can be used up to about 15 percent acid concentration. Monel equipment commonly is used in such applications as the sulphuric acid pickling of steel; sulphuric acid splitting of fats; sulphuric acid washing of organic materials such as petroleum products, vegetable and animal oils, benzene, napthalene and other coal tar products; sulphation of vegetable and animal oils; production of ammonium sulphate; and evaporation of non-oxidizing inorganic acid sulphates such as zinc sulphate, stannous sulphate, magnesium sulphate, nickel sulphate and sodium bisulphate.

Nickel and Inconel frequently can be used with sulphuric acid solutions at low or moderate temperatures although they usually are less resistant than Monel. Their corrosion rates often are increased considerably by elevated temperatures. Neither material would be used in boiling solutions above about 1 percent concentration. The results of laboratory corrosion tests of nickel and Inconel in sulphuric acid solutions are shown in Table I. Corrosion of both materials is increased by a high degree of aeration except in concentrated acid at room temperature. Corrosion of nickel is increased considerably by the presence of oxidizing salts in acid solutions. The oxidizing capacity of such solutions frequently is sufficient to passivate Inconel at atmospheric temperature but not at elevated tempera-



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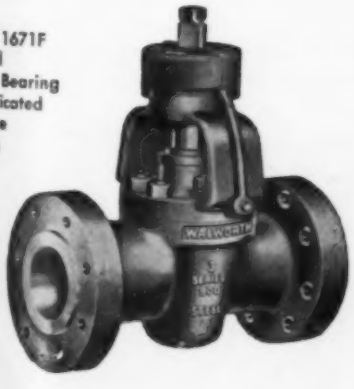


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Automatic unit for filling containers in predetermined quantities from one pint to nine quarts. Temperature control and specific gravity adjustment.

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Table II—Laboratory Corrosion Tests of Type 1 Ni-Resist in Sulphuric Acid

Conc., Wt. % H_2SO_4	Temp., Deg. F.	Duration of Tests 20 Hr. Corrosion Rate, Mils Per Yr. Quiet	Agitated*
5	86	16	95
5	194	380	810
10	86	18	82
10	194	528	1,206
30	86	53	56
30	194	1,295	2,518
50	70	.....	38
75	70	.....	113
80	86	17	20
80	194	245	502
95	70	.....	43
96	194	227	458

*Velocity 15.5 fps.

tures. A common application for nickel is for tubes in the evaporation of viscose rayon spinning baths when solution temperatures are kept below about 122 deg. F. by vacuum. Common applications for Inconel are for pickling baskets in the sulphuric acid pickling of brass and copper at atmospheric temperature, and for handling acid dye baths.

The Ni-Resist alloys can be used to advantage in handling very dilute unaerated sulphuric acid solutions or solutions of inorganic non-oxidizing acid sulphates at low or moderate temperatures. Type 1 Ni-Resist (containing 13.5 to 17.5 percent Ni and 5.5 to 7.5 Cu) usually is somewhat more resistant than other types of Ni-Resist because of its copper content. The results of laboratory corrosion tests of Type 1 Ni-Resist are shown in Table II. It will be noted that corrosion rates are increased by increase in temperature, aeration or velocity. The Ni-Resist alloys are somewhat similar to cast iron in resistance to concentrated sulphuric acid. Type 3 Ni-Resist (containing 28 to 32 percent Ni) can be used in fuming sulphuric acid at elevated temperatures and is resistant to cracking which sometimes occurs with cast iron.

REPRINTS

Conclusion this month of the symposium, Sulphuric Acid versus Construction Materials, brings to nine the number of articles and symposiums that have appeared in this series. Each is available as a reprint from Editorial Dept., Chemical Engineering, 330 W. 42nd St., New York 18, N. Y. Prices are as follows:

Phosphoric acid	25c.
Sulphur and sulphides	10c.
Acetic acid	25c.
Chlorine	25c.
Hydrogen peroxide	15c.
Sulphur dioxide	25c.
Sodium chloride	25c.
Nitric acid	25c.
Sulphuric acid	25c.

Reducing Dezincification

Admiralty, Muntz Metal and Aluminum Brass condenser and heat exchanger tubing is used extensively in petroleum refineries, petro-chemical and chemical plants. Admiralty still is the most popular all-around heat exchanger and condenser tubing alloy used in oil refineries. Because of high zinc content, dezincification on the water side was for many years a frequent cause of premature failure of such tubing. During the past decade dezincification has been considerably reduced by the more widespread use of the same alloys containing dezincification inhibitors. However, some operators are having trouble with dezincification where uninhibited Admiralty is still in use.

How Dezincification Is Recognized—Dezincification is a type of corrosion occurring in uninhibited brass alloys containing a high percentage of zinc. It is recognized by the presence of reddish-brown areas which may be in the form of plugs or continuous layers. Analyses of these brittle deposits prove them to be approximately 100% copper. This is known as dezincification because the zinc has gone into solution in the circulating water, leaving redeposited copper.

In some cases, other forms of corrosion may be mistaken for dezincification. When in doubt, it is suggested that operators submit full length samples of tubing to Bridgeport's laboratory for examination. Samples should be carefully marked as to inlet end, top and bottom, and location in the unit, and accompanied by pertinent data regarding operating conditions, water analyses, etc.

Factors Favoring Dezincification: Dezincification occurs in many different types of waters—both salt and fresh. It is favored by:

(a) a limited supply of dissolved oxygen as found beneath semi-porous deposits such as rust, cotton, lint, decomposing wood, silt, etc.;

(b) the presence of certain salts, particularly the chlorides and to a lesser extent sulfates and nitrates—for example, the rate of dezincification in sea water is considerably more rapid than that encountered in fresh water;

(c) soft, non-scale-forming fresh water;

(d) low water velocity which permits deposition of foreign matter;

(e) elevated temperature which generally accelerates dezincification.

Preventing Dezincification—Investigation has shown that dezincification can be stopped or inhibited by adding inhibitors—arsenic, tin, antimony or other elements. Arsenic has proved very dependable and since 1936 the addition of arsenic to condenser tube alloys has been standard practice with Bridgeport Brass Company.



Illustrating typical plug-type dezincification in uninhibited brass condenser tubing. Longitudinal section mag. about 4X.

The addition of arsenic, even in concentrations as low as 0.01%, is very effective in reducing dezincification of Admiralty or Aluminum Brass. A somewhat higher concentration of arsenic is used in Muntz Metal*, and has proved quite effective. Addition of arsenic to Muntz Metal also has lowered the over-all corrosion rate about two-thirds under certain conditions. Arsenic also improves the over-all corrosion resistance of Duronze IV** (aluminum bronze).

Preventive Measures—In view of the fine results obtained from Arsenical Admiralty, Arsenical Aluminum Brass, Arsenical Muntz, etc., one of the surest methods of combating dezincification is to use such inhibited alloys. Other measures consist of maintaining as low temperatures as practical and keeping tube surfaces smooth and clean.

Contact the nearest Bridgeport office for information about available condenser tube alloys, and write for 120-page Condenser Tube Manual containing valuable information on condenser tubing, corrosion research, etc.

*Reg. U. S. Pat. No. 2118688
**U. S. Pat. No. 2093380

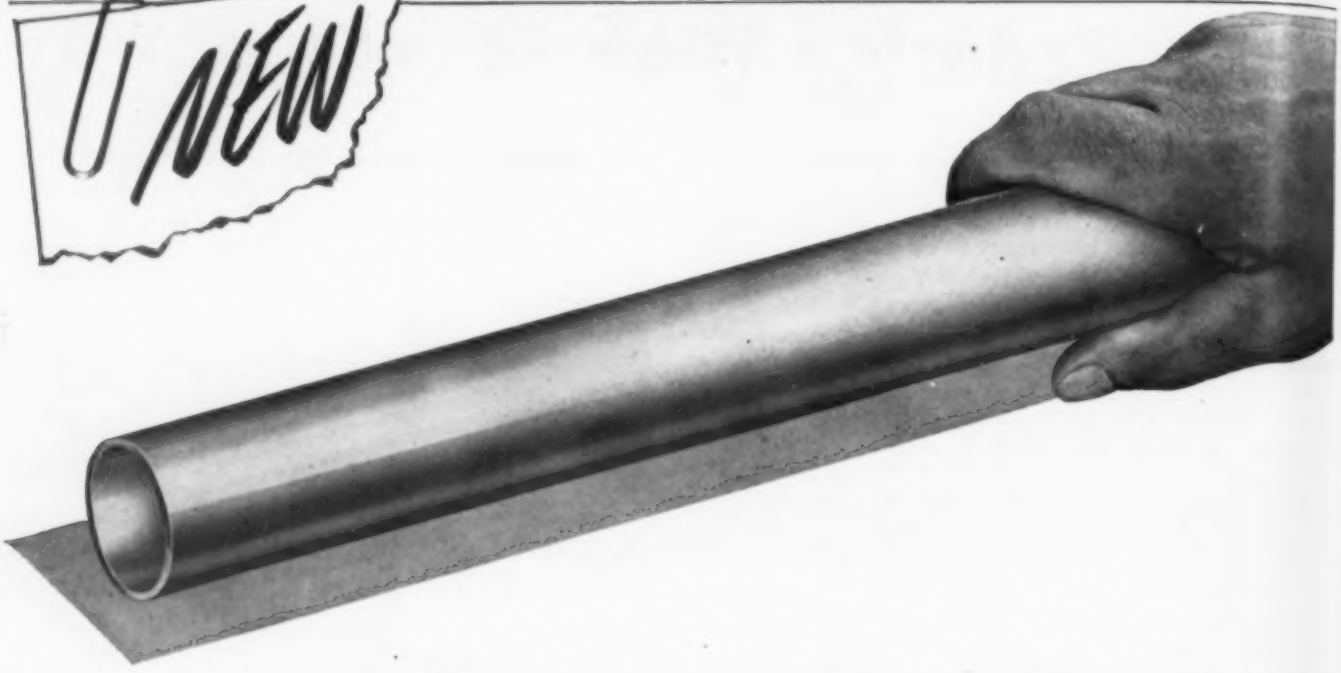
"Bridgeport"

BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • *Established 1865*
Mills at Bridgeport, Connecticut, and Indianapolis, Indiana
In Canada—Noranda Copper and Brass Limited, Montreal

CONDENSER AND HEAT EXCHANGER TUBING



NEW



Carpenter Stainless Tubing No. 20

for jobs where you need EXTRA Corrosion Resistance...

For the first time this Stainless alloy is available in the form of tubing.

In the past, it has been available only in the cast form, known as Durimet 20. As a result of Carpenter's solving the problem of producing the alloy in wrought forms, its usefulness has been greatly increased.

Carpenter Stainless Tubing No. 20 provides an extra margin of safety, over and above the corrosion resistance of other types of Stainless. It provides excellent resistance to sulphuric acid solutions, and many other corrosive agents.



For more information about the corrosion resistance, physical and mechanical properties of this new material, ask for the Carpenter Stainless No. 20 Data Sheets. A note on your company letterhead will start your Data Sheets on the way to your desk.

THE CARPENTER STEEL COMPANY • ALLOY TUBE DIVISION
105 Springfield Road, Union, N. J.

Carpenter Stainless Tubing No. 20 — TYPE ANALYSIS:

Carbon .07% max. Manganese .75% Silicon 1.00% Chromium 20.00%
Nickel 29.00% Molybdenum 2.00% min. Copper 3.00% min.



For information about Carpenter Stainless No. 20 in the forms of bar stock, wire and strip, get in touch with THE CARPENTER STEEL COMPANY, 127 W. Bern St., Reading, Pa.

Carpenter

STAINLESS TUBING NO. 20

LICENSED UNDER PATENTS OF THE DURIRON CO., INC.

NAMES IN THE NEWS

Man of the Month



E. R. Weidlein

America's top chemistry honor, the Priestley Medal, will be presented to Edward R. Weidlein September 6. Dr. Weidlein will receive the award in St. Louis at the Midwest session of the 114th meeting of the American Chemical Society.

Dr. Edward Ray Weidlein, scientist, inventor, author, and director of Mellon Institute for Industrial Research, with which institution he has been actively identified for 32 years, was born July 14, 1887, at Augusta, Kan. He graduated with an A.B. degree from the University of Kansas in 1909, a M.A. in 1910. Shortly after the completion of his collegiate training he was appointed an industrial fellow. In 1916 he came to Mellon Institute as assistant director and was soon appointed associate director. He was acting director through out the war and in 1921 was appointed director. Since that time he has devoted exclusive time and attention to the duties of that office.

Dr. Weidlein was largely responsible for planning and organizing the synthetic rubber program of World War II. From 1940 to 1942, he was chief of the chemicals branch of WPB and for the next four years he was senior consultant to the chemical division and head technical consultant for the WPB. He was technical advisor to the research and development division of the Army's Quartermaster Corps and also served on a number of advisory committees.

Long active in scientific and civic affairs, Dr. Weidlein is a member and past president of both ACS and AIChE, a Fellow of AIC, and a member of numerous scientific and technical societies both in this country and abroad.

Dr. Weidlein was married April 24, 1915, has three sons, hunts and plays golf, is a republican. His home is at 325 South Dallas Ave., Pittsburgh.

R. E. Thomas is director of a new Du Pont laboratory devoted to research and development work in the field of coated fabrics and allied products. The Newburgh, N. Y., laboratory is part of the chemical division of Du Pont's fabrics and finishes department.

Frank Maslan has been appointed assistant professor of chemical engineering at New York University.

Eldon E. Stahly has been appointed director of chemical research for Commercial Solvents Corp. Dr. Stahly will supervise all laboratory research leading to the development of new products and processes.

Sydney Ross, senior chemist at the Oak Ridge, Tenn., laboratories, has been appointed an associate professor of chemistry on the staff of Rensselaer Polytechnic Institute.

L. L. Davis has been named manager of Continental Oil Co.'s newly established research and development department at Ponca City, Okla. **J. S. Hume**, resident chemist at the company's Ponca City refinery, has become assistant superintendent. He succeeds **L. W. Vickery**, who has been made refinery superintendent.

Louis W. Munchmeyer, formerly vice president in charge of operations of Michigan Chemical Corp., has joined General Aniline & Film Corp. as assistant to the vice president in charge of research and development.

John E. Ford, Jr., has been elected vice president in charge of engineering and sales and **J. S. Reynolds** vice president in charge of construction for W. M. Barnes Co., Los Angeles.

Evan F. Wilson of Akron, Ohio, has been appointed assistant director of the division of raw materials, U. S. Atomic Energy Commission. Mr. Wilson will be responsible for the research program of the division of raw materials which is concerned principally with the development of methods of extracting uranium from low grade domestic sources.

Fernley H. Banbury, inventor of the Banbury mixer, has been awarded an honorary degree of doctor of engineering by Purdue University.

Robert E. Workman, chemical engineer for the Goodyear Tire & Rubber Co., has been named a special representative of the company's newly-created chemicals division, and will be stationed at St. Louis.



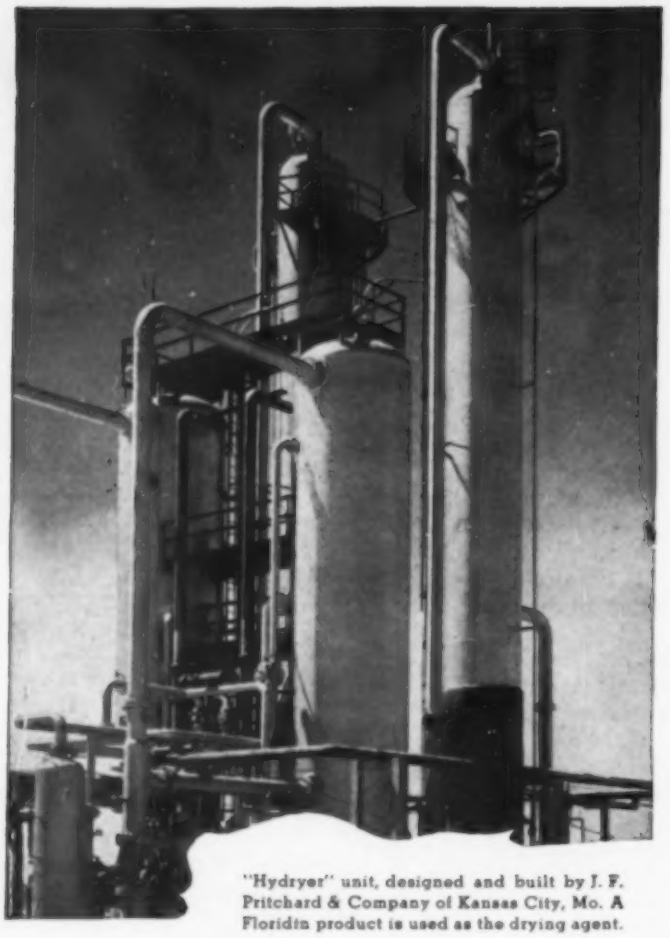
R. Workman



M. G. Fontana

M. G. Fontana has been appointed chairman of the department of metallurgy at Ohio State University. Dr. Fontana has been on the staff since November 1945. Prior to that he was with du Pont for 11 years. He continues on the staff of the engineering experiment station at Ohio State.

Haldon A. Leedy, acting director of Armour Research Foundation of Illinois Institute of Technology, has been named director. Dr. Leedy was named acting director of the foundation March 12 following the resigna-



"Hydryer" unit, designed and built by J. F. Pritchard & Company of Kansas City, Mo. A Floridin product is used as the drying agent.

FLORIDIN products, known and approved for more than thirty-five years, have been adapted, by continuous research, for the most advanced modern uses. On any problem of adsorption—dehydration—catalysis—decoloration, you may find an answer in

Floridin ADSORBENTS

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BAUXITE-BASED ADSORBENTS

FLORITE (refining grade)
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Your inquiry will be given careful attention and a prompt reply.

FLORIDIN COMPANY
ADSORBENTS
Department A, 220 Liberty St. Warren, Pa.

tion of **Jesse E. Hobson,** who went to California as director of the Stanford Research Institute.

J. C. Moore has been promoted to the position of laboratory division leader in Dr. Strosacker's laboratory on special research problems at the Dow Chemical Co., Midland, Mich.

Joseph A. Korany has joined the research and development laboratories of Quaker Chemical Products Corp. He will undertake market studies of new products as well as new applications of old products.

Raymond E. Zimmerman has resigned his position as preparation manager of the Hanna Coal Co. to accept a professorship at Pennsylvania State College where he will become chief, mineral preparation division of the school of mineral industries.

J. Carl Bode, formerly operating manager, has been elected president of National Carbide Corp. Mr. Bode succeeds **L. A. Hull** who becomes chairman of the board of directors.

M. A. Sievert has been appointed an engineer in the technical service department, Reynolds Metals Co., Louisville.

Robert L. Gibson has been named manager of the General Electric Co.'s plastics division.



R. L. Gibson



W. M. Creasy

William M. Creasy has been appointed chief, research and engineering division at Army Chemical Center, Maryland. Prior to reporting to this station, Colonel Creasy was serving as deputy to Lieut. General Henry S. Aurand, director of research and development, general staff, Department of the Army.

Harold E. Graves has left the department of chemical engineering at Worcester Polytechnic Institute and is now with the department of chemical engineering at Rhode Island State College, Kingston.

P. George Maercky has been named vice president of Texas Gulf Sulphur Co. at Houston, Tex. Formerly



De Laval pump fitted with submerged suction priming system.

THE DE LAVAL SUBMERGED SUCTION PRIMING SYSTEM

As soon as the pump is started the De Laval submerged suction priming system automatically floods the pump to the eye of the impeller.

With the De Laval Priming System the pump cannot be started unprimed. Were the air inleakage too great for the priming system to handle, the pump would automatically be shut down and could not be started again until the fault had been corrected.

The pumping unit can be started or stopped at any time, from a remote control point, if desired.

Ask for Literature

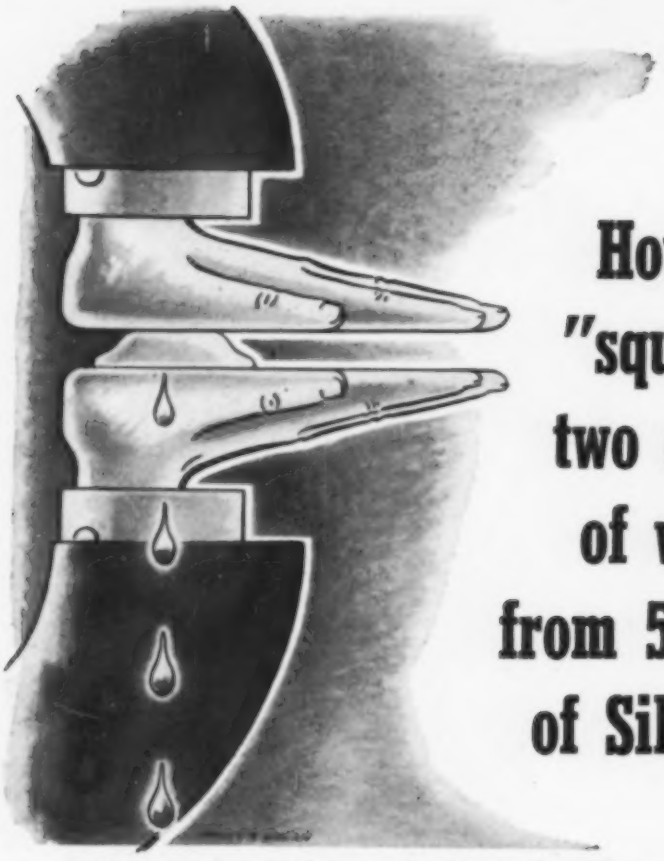
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DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

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How to "squeeze" two quarts of water from 5 pounds of Silica Gel

Silica Gel, a cracking catalyst for high octane gasoline, is almost 90% water by weight!* Refiners found the dehydrating methods they were using were far too expensive and slow. So they dumped their drying problem into Hersey's lap.



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Result: Faster, more efficient drying, **nearly 80% cheaper than the old method** . . . greater fuel economy . . . lower initial equipment cost.

For a successful solution to your drying problem, call on Hersey. No obligation for a consultation—write or wire today.

*As it comes from the filter press.

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MANUFACTURING COMPANY

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assistant to the executive officers of the company, he will continue to maintain his offices in Houston.

Karl Cohen, one of the leading contributors to the design of the gaseous diffusion plant at Oak Ridge, and former specialist on industrial applications of atomic energy for the Standard Oil Development Co., has joined the H. K. Ferguson Co.



K. Cohen



R. R. Kidd

Robert R. Kidd has been named chief chemist at the Goodyear Tire & Rubber Co.'s plant in Buitenzorg, Java.

Dwight Bardwell, former research director, Allied Chemical & Dye Corp., has accepted the position of director of the chemistry division of the Oak Ridge National Laboratory, Oak Ridge, Tenn.

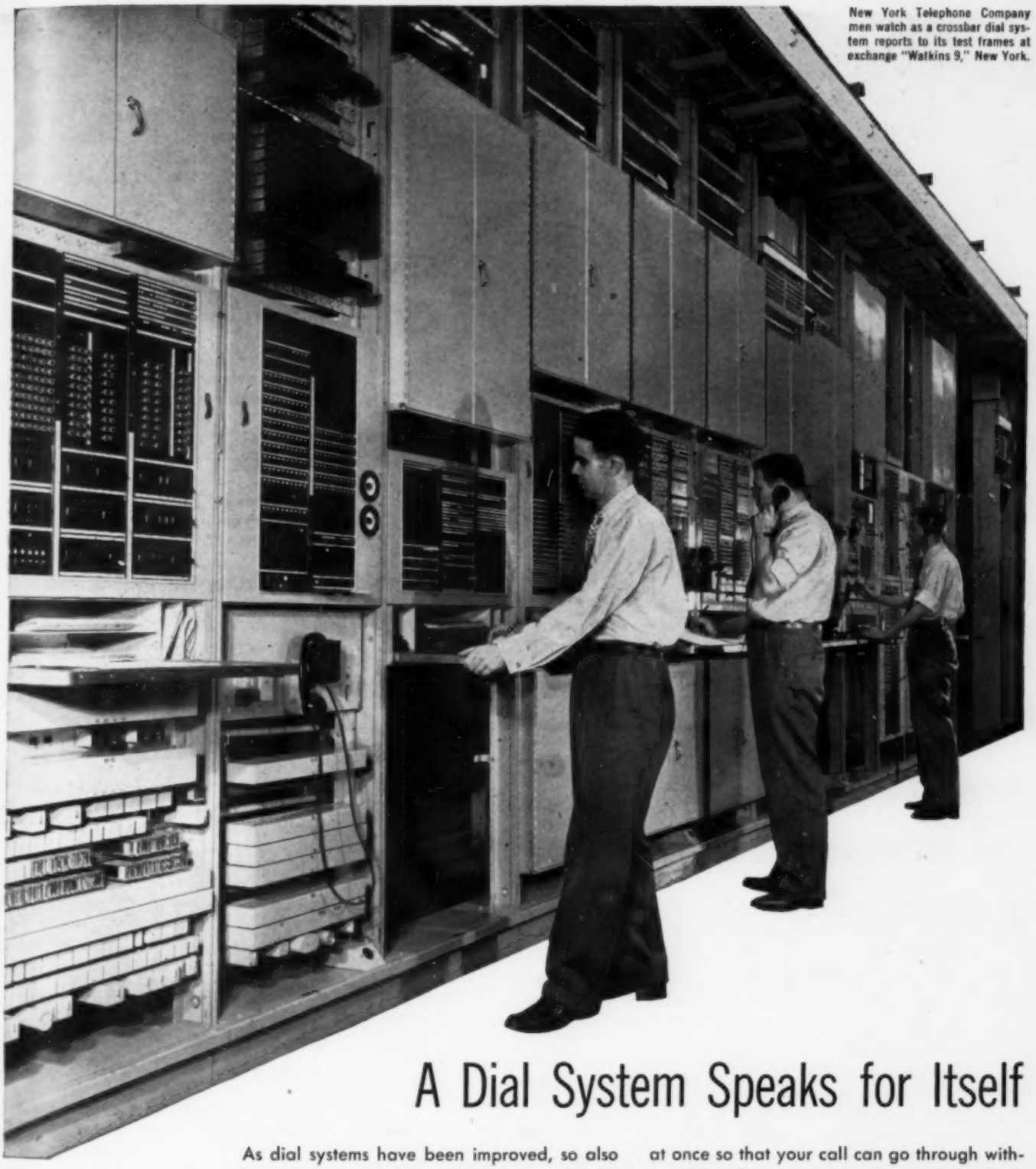
Philip J. Wilson, Jr., has left Mellon Institute to join the research and development division of the Carnegie-Illinois Steel Corp., Pittsburgh, as a research associate. **Joseph H. Wells**, who also has been on the Carnegie-Illinois fellowship since it was founded, now heads its activities.

J. L. Williams has been named laboratory director of the styron control and development laboratory at the Dow Chemical Co., Midland, Mich. Named as assistant laboratory director for the same laboratory was **R. E. Peterson.**

Frederick H. Weismuller has been appointed general manager of the pigments department of E. I. du Pont de Nemours & Co. He succeeds **John F. Daley**, who is now general manager of the organic chemicals department. **D. H. Dawson**, formerly sales director of the pigments department succeeded Weismuller as assistant general manager.

Scott E. Wood, assistant professor of research and physical chemistry at Yale University, has been appointed associate professor of chemistry at Illinois Institute of Technology, effective September 1.

Harold F. Smiddy has been appointed general manager of the chemical de-



New York Telephone Company men watch as a crossbar dial system reports to its test frames at exchange "Watkins 9," New York.

A Dial System Speaks for Itself

As dial systems have been improved, so also have the means of keeping them at top efficiency. Even before trouble appears, test frames, developed in Bell Telephone Laboratories, are constantly at work sending trial calls along the telephone highways. Flashing lamps report anything that has gone wrong, and the fault is quickly located and cleared.

If trouble prevents one of the highways from completing your call, another is selected at once so that your call can go through without delay. Then on the test frames lights flash up telling which highway was defective and on what section of that highway the trouble occurred.

Whenever Bell Laboratories designs a new telephone system, plans are made for its maintenance, test equipment is designed, and key personnel trained. Thus foresight keeps your Bell telephone system in apple-pie order.

BELL TELEPHONE LABORATORIES *EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE*



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load 120 tons of ammonia sulphate per hour

A LEADING eastern railroad had to speed up handling bulk sulphate of ammonia from freight cars to freighters to meet stepped-up sailing schedules. A series of Farquhar Trough Conveyors helped solve the problem—Model 346's installed below the floor of the pier, and Model 347's (shown here) combining with bucket elevators to load an average of 120 tons per hour. At that rate, it takes less than half the time to load a freighter's hold as formerly, plus a big saving in manpower also.

Farquhar Trough Conveyors handle sharp or abrasive materials, fine or powdery materials, small bags and bundles *faster, better, cheaper*—for all kinds of plants, all types of industry. They can be fitted into materials handling set-ups that cut thousands of dollars from overhead, release manpower for other uses, speed up the entire operation. Come in all sizes and mountings for all requirements.

No matter what you move, stack, pile or load—see Farquhar first for the *right* materials handling conveyor for your job—whether for portable, semi-permanent or permanent use. Tell us your problem—we're ready to help.

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CONVEYORS

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partment of General Electric Co. Mr. Smiddy's headquarters will be in Pittsfield, Mass.

Allen N. Smith is now assistant professor, department of chemical engineering, University of Louisville, Louisville, Ky. He was formerly connected with Union Oil Co. at Wilmington, Calif.

J. Enrique Zanetti, professor of chemistry and director of chemical laboratories at Columbia University, has been appointed to the post of associate provost in the University.

Lewis H. D. Fraser and **Glen H. Hedrick** have joined the technical staff of the department of chemistry and chemical engineering at Armour Research Foundation of Illinois Institute of Technology.

C. E. Bransky, assistant general manager of the manufacturing department, will retire September 1 after more than 38 years' service with Standard Oil Co. (Indiana). **W. J. McGill,** manager of the Whiting, Ind., refinery, has been promoted to the new position of superintendent, manufacturing operations in the Chicago office. **J. C. Ducommun** succeeded Dr. McGill as manager at Whiting.

Caspar Kaffke has been appointed by Prior Chemical Corp. to be assistant vice president. He will act as technical adviser in research and development work.



C. Kaffke



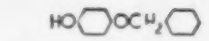
W. A. LaLande, Jr.

William A. LaLande, Jr., for the last two and a half years director of the Whitemarsh research laboratories of Pennsylvania Salt Manufacturing Co., has been appointed director of research and development. In his new post Dr. LaLande will continue to exercise control of the Whitemarsh laboratories. **S. C. Ogburn** has resigned as manager of the research and development department.

H. F. Ballenger will become an assistant professor of chemistry at Baylor University this year. At present superintendent of Culter Academy, Los Angeles, Ballenger was a research chemist in the radiation laboratory of

Good-rite
CHEMICALS

Ethers of Hydroquinone


Monobenzyl Ether of Hydroquinone

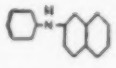

Dibenzyl Ether of Hydroquinone

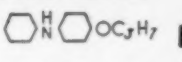
Monobenzyl ether of hydroquinone may be used as an antioxidant, stabilizer, or plasticizer in pharmaceuticals, paints, varnishes, and organic synthesis.

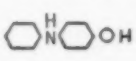
Dibenzyl ether of hydroquinone may be used as a high boiling solvent for perfumes, cosmetics, pharmaceuticals, plasticizers, paints, varnishes, and organic synthesis.

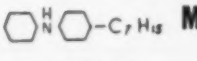
Other organic chemicals

Secondary Aromatic Amines

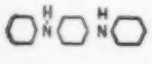

Phenyl B-Naphthylamine

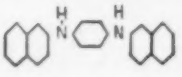

p-Isopropoxy Diphenylamine


p-Hydroxy Diphenylamine

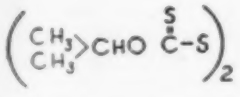

Mixed Mono and Diheptyl Diphenylamines

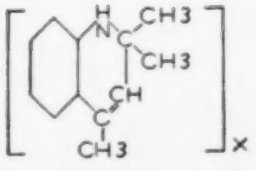
Di-secondary Aromatic Amines

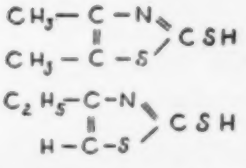

Diphenyl p-Phenylenediamine

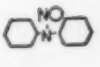

Di B-Naphthyl p-Phenylenediamine

Miscellaneous


Di-Isopropyl Dixanthogen


Trimethyl Dihydro Quinoline Polymer


Mixed Ethyl and Dimethyl Mercaptothiazoles


N-Nitroso Diphenylamine

All materials listed here are available in commercial quantities. Prices and technical information are available on request. Please write Dept. CD-8, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

B. F. Goodrich Chemical Company

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New! TERRISS 3-SPEED
PORTABLE MIXER
STIRS • BLENDS
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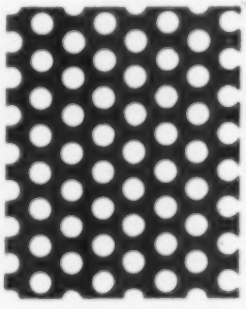
No more carrying heavy mixer . . . clamping to tanks . . . breaking side walls

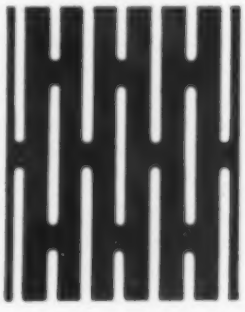
The New TERRISS 3-speed Portable Mixer is an all-around unit that will take care of all your mixing, blending and agitating problems. If your tank or vat is below floor level the TERRISS 3-speed Mixer will reach down and do a real job for you. If your container sits on the floor, a little adjustment and the mixing begins. If your tank or container is high off the floor, the TERRISS Mixer will lift up and do the mixing job. All parts that touch your product are Stainless Steel. Standard belt drive permits propeller speeds of 175 RPM, 325 RPM and 575 RPM. Other combinations are available with simple adjustments. Both propeller shaft and stand are adjustable, permitting unlimited settings to fit any job in your plant.



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When *Corrosion* is a screening problem

For processes where it is important that equipment be corrosion-resistant, Hendrick furnishes perforated metal screens of stainless steel, Monel, Everdur, bronze, copper or aluminum.

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Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

the University of California during the war.

Douglas E. Ryan of the University of New Brunswick, Canada, has been appointed instructor in chemistry at Illinois Institute of Technology.

Sydney Smith, production manager at Monsanto's Ruabon plant, has been appointed works manager at the company's new £2,000,000 works at Newport, Monmouthshire. His place as production manager at Ruabon is filled by **W. A. Hayward,** formerly divisional manager of the heavy chemicals division. Dr. Hayward's former position is now filled by **N. B. Dyson.**



S. Smith



G. Heinemann

Gustave Heinemann, chief chemist at the Corpus Christi, Tex., plant operated by Southern Alkali Corp. has assumed the additional duties of technical director.

Henry T. Gillen, consulting superintendent of Goodyear Tire & Rubber Co., has retired.

Paul O. Huntington has been elected vice president of New England Alcohol Co.

Frederick H. Warren, chief, production facilities control branch, engineering division, United States Atomic Energy Commission, has been appointed chief of the engineering-construction branch, engineering division. **Kirby K. Wyatt,** former chief, will remain on the staff of the division as a consultant.

Allen L. Chaplin has been appointed project engineer at the Natrium, W. Va., plant operated by the Columbia Chemical division of Pittsburgh Plate Glass Co.

Edwin G. Greene, chemist and patent agent, has resigned from the Atomic Energy Commission after five years of service in the Manhattan Project to assist Paul W. Garbo, New York consultant in chemical and patent matters.

Hugh A. Neal has been appointed manager of Absorption Plant, Inc., and McCarthy Chemical Co. **Leon Dorsey** has been named production superin-

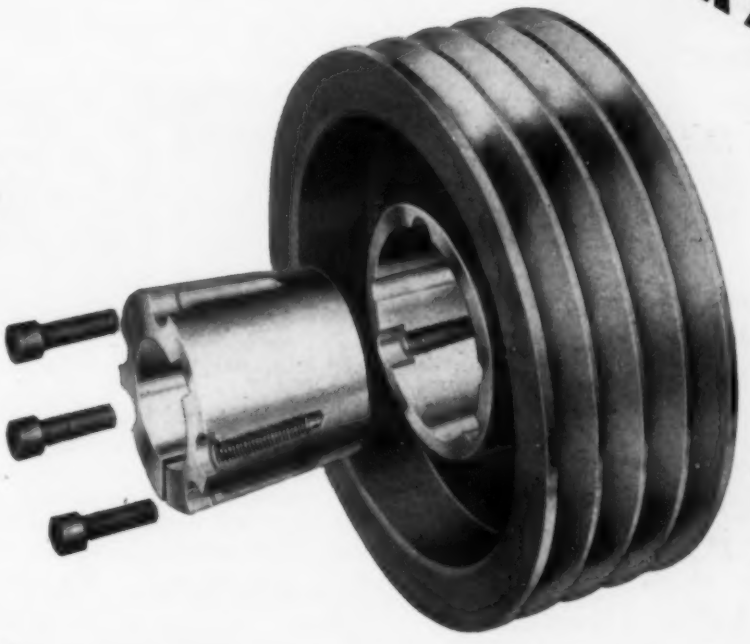
IT'S TAPER-LOCK! IT'S REVOLUTIONARY!

The simplest, surest mechanism ever devised for holding wheels to shafts. Another Dodge "first" —and the biggest development in this field in years!

The TAPER-LOCK Sheave breaks all speed records in mounting. Slip it on, line it up and tighten while sighting! Saves time—saves money.

Easy on, easy off! Disengages with less effort; holds fast to the shaft with firmness equivalent to a shrunk-on fit.

No flange. No collar. No protruding parts. Close mountings are possible. Bushing extends entire length of hub. TAPER-LOCK runs *true*.



A complete unit—in a complete range of sizes in Dual Duty (A and B); B, C, and D grooves. Write us for detailed bulletin, A175C, on this new and different taper bore sheave.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

He is your local Dodge Distributor—factory trained—qualified to suggest ways to improve your machine performance, increase production. Look for his name under "Power Transmission Equipment" in your classified phone book.



TAPER-LOCK: Trade Mark Registered U. S. Pat. Off.

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SPECIFY

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

AVOID COSTLY SHUTDOWNS DUE TO *CORROSION*...



SPECIFY

HAVEG

EQUIPMENT FOR

CORROSION RESISTANCE THAT'S MORE THAN SKIN DEEP

- Agitators
- Baskets
- Blowers
- Fume Duct
- Filters
- Kettles
- Piping
- Pumps
- Tanks
- Towers
- Many Others

HAVEG is a molded structural material that is completely acid and alkali resistant throughout its entire mass . . . it is not a lining nor a coating!

Large size equipment can be molded at low cost in one piece without seams or joints and installation accomplished easily and economically.



Send for Bulletin F-5 for complete design, engineering and application data.

HA-6-47

HAVEG CORPORATION
NEWARK 8, DELAWARE



tendent and **E. E. Holden** maintenance and construction superintendent.

James W. Westwater, who recently received the first doctorate degree in chemical engineering awarded by the University of Delaware, has been appointed assistant professor of chemical engineering at the University of Illinois. **Thomas Baron** has been appointed instructor.

Albert W. Fuhrman has been appointed research chemist in the chemicals division's laboratories of The Glenn L. Martin Co.

Gerald J. Leuck, director of research of the Glyco Products Co. has been transferred to the Natrium, W. Va., plant. He has been promoted to the position of technical director.

Arnold H. Smith has been elected president of Monsanto (Canada), Ltd. with offices in Montreal. **Leo G. Ryan** remains as chairman of the board. **L. E. Ryan** was elected first vice president.



W. P. Marsh, Jr.



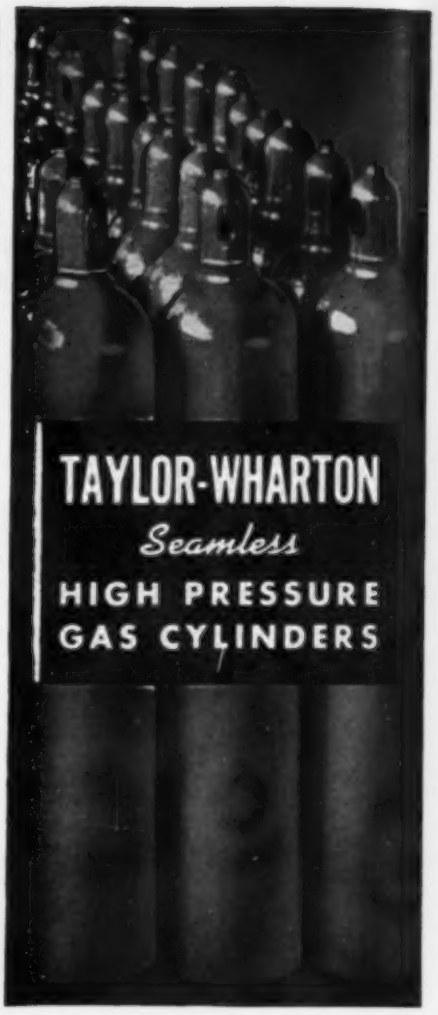
G. L. Haskell

William P. Marsh, Jr., executive vice president of U. S. Industrial Chemicals, Inc., has been elected president. He succeeded **Glenn L. Haskell** who has retired and been named vice chairman of the board.

Myron J. Coplan, for the past six years production manager of the Montrose Chemical Co., has joined the research staff of the Institute of Textile Technology. Mr. Coplan has been assigned to the chemical engineering division of the institute.

Norburn E. Philpot, for many years manager of sales engineering in New York for the Duriron Co., has taken over the sales engineering representation of Dean Hill Pump Co. of Indianapolis.

Harold E. Wessman has been named dean of the University of Washington College of Engineering, Seattle. Dr. Wessman has been chairman of the civil engineering department, New York University, for 11 years. He succeeds **Edgar A. Loew** who will retire



Prompt service on your needs for

CHLORINE, OXYGEN, HYDROGEN, CARBON DIOXIDE, NITROUS OXIDE, NITROGEN, ETC.

Diameters up to 13"

• All Taylor-Wharton cylinders are made by the reliable "billet" process to the highest standards of manufacturing, testing and inspecting. Bottoms are integral (not spun), wall thicknesses are carefully controlled for uniformity. Complete, modern facilities to meet all your needs as to quantity, types and sizes. Let us quote on your requirements.

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TAYLOR-WHARTON IRON & STEEL COMPANY

Cylinder Sales Office:
110 E. 42 St., New York 17, N. Y.

HIGH BRIDGE, N. J. & EASTON, PA.
Cable: TISCOSTEEL,
Washington, New Jersey, U. S. A.

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

Cut the Cost of Cotton Filter Cloths

—by making them

Last Longer

with

THŌRATEX

REG. U. S. PAT. OFF.

- Frequently outlast untreated cloth 3 to 1
- Resists corrosive action of caustic and alkaline solutions
- Mildew and rot resistant
- Maintains filtering capacity
- Smooth surface
- Cakes come away easily
- Reduce gumming
- Fewer washings required
- More continuous press operation
- Less shrinkage on press
- May be used in cold or boiling filtrations
- May be used with hydrocarbon solvents
- Better filtration
- Soft, flexible—sews easily

FREE TRIAL

Send us, prepaid, a roll of your cloth for finishing. Try it under actual plant operations.

Information and samples on request

SPRINGDALE FINISHING SOUTH, Inc.

Sales office

320 Broadway, New York, N. Y.

Mill: Whitney, So. Carolina

September 1 after 42 years of service on the Washington engineering faculty.

E. H. Reichl has been promoted to the position of manager of the research department of the research and development division of Pittsburgh Consolidation Coal Co.

A. George Stern, San Francisco, has joined Heyden Chemical Corp., New York, as western sales representative.



A. G. Stern



R. B. Seymour

Raymond B. Seymour has accepted an appointment as director of the special products research division of Johnson and Johnson, New Brunswick, N. J.

Karl F. Bonhoeffer of the Kaiser Wilhelm Institute in Berlin, Germany, authority on physical chemistry, was the first Reilly Lecturer in Chemistry at the University of Notre Dame this summer.

James J. Donnelly and **F. A. Angona** are recipients of fellowships awarded by the Socony-Vacuum Oil Co. Mr. Donnelly and Mr. Angona will receive leaves of absence from the company's laboratories with full pay to pursue their studies for doctors' degrees.

OBITUARIES

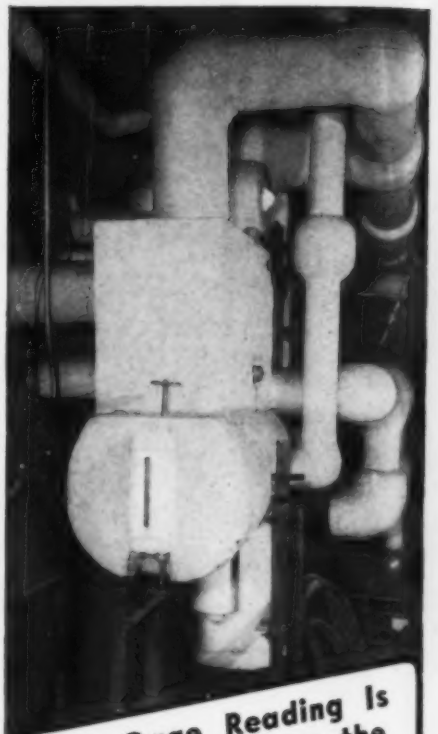
A. Felix du Pont, Sr., 69, a director, former vice president, and great grandson of the founder of E. I. du Pont de Nemours & Co., died at his summer home in Rehoboth Beach, Del., June 29.

Clarence W. Balke, 68, metallurgist who developed commercial tantalum, and Perkin medallist for 1948, died in Chicago July 8.

Abraham A. Shimer, retired engineer of Hercules Powder Co., died in Philadelphia July 10.

Horace J. Macintire, 68, professor of refrigeration in the department of mechanical engineering at the University of Illinois, died July 15.

George W. Dolan, 46, chairman of the board of the Mathieson Chemical Corp., died in New York July 23.



The Gage Reading Is Always Visible on the NON-FROSTING JERGUSON GAGE



Special design of the Jerguson Non-Frosting Gage prevents frost from forming over the vision slot.

If you are gaging low temperature fluids . . . and have difficulty with frost on the vision slot . . . you need Jerguson Non-Frosting Gages.

With the Jerguson Non-Frosting Gage the liquid level reading is *always visible.*

A special frost preventing unit sealed to the gage glass projects beyond the cover bolts so the frost cannot build up across the vision slot in the cover forging.

Don't guess any longer. Use Jerguson Non-Frosting Gages and *be sure* of your liquid level readings on low temperature work.

Write for prices and full details.

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Traylor Has Solved a Calcining Problem Very Similar to Yours!





No two processing operations are exactly alike. Neither is the equipment that each requires. While all Rotary Kilns employ certain basic principles, there is only one combination of precisely calculated specifications that is the answer to any one calcining problem.

In arriving at these specifications there is no substitute for experience. That's where Traylor has an outstanding advantage. An advantage of 40 years of building Kilns for every segment of the process industries. Yes, it's safe to say that Traylor has designed, built and installed in the past, a Rotary Kiln as the answer to a calcining problem very similar to *any* you may have.

Consult Traylor engineers. You can then rest assured that your kiln will be the best that modern engineering can build.





Many outstanding refinements in Rotary Kiln design have evolved from Traylor's long experience. Each new feature was adopted only after intensive research proved that it either . . . (a) improved product quality or (b) reduced operating and maintenance costs.

We will be glad to send you our illustrated bulletin No. 115. It describes in complete detail the many proven features of Traylor Rotary Kilns, Coolers and Dryers. Send for your copy today.

TRAYLOR ENGINEERING & MANUFACTURING CO.
101 Mill Street, Allentown, Pa.

TRAYLOR *Rotary Kilns, Coolers & Dryers*





Serving Our Biggest *STEEL MILLS*

• • • WOVEN into the fabric of America's great steel industry are many fine Layne Well Water Systems. They are more than qualified in capacity and quality to produce all the water needed for Steel Mill use; cooling, cleansing, waste dispersal, drinking, bathing, fire, etc. Their rugged construction gives years of low upkeep service.

But as with Steel Mills, Layne Well Water Systems are also serving other great industries; chemical plants, oil refineries, paper mills, packing houses, factories and big and little cities by the hundreds.

It is a well known fact that Layne Well Water Systems are built to the very highest standards. They are installed exclusively by the Layne Organization Affiliated Companies —and according to Layne's exacting specifications.

Layne also provides valuable engineering counsel on water and pump needs for all commercial, industrial and municipal needs. There is no obligation for this service.

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INDUSTRIAL NOTES

J. W. Greer, Cambridge, Mass., has sold its wire belt division to the Wire Belt Co. of America.

Texas Gulf Sulphur Co., New York, has begun production of sulphur at Moss Bluff near Liberty, Tex. P. George Maercky has been elected vice president of the company. His headquarters will be at Houston, Tex.

E. I. du Pont de Nemours and Co., Wilmington, has opened a new laboratory devoted to research and development work in the field of coated fabrics and allied products. The laboratory is directed by R. E. Thomas.

H. K. Ferguson Co., New York, has appointed Harry C. Williams general sales manager.

Continental Foundry & Machine Co., Chicago, has purchased the Vulcan Soot Blower Corp., DuBois, Pa., and the Northern Equipment Co., Erie, Pa. George L. Davis has been elected president of the former company and director of the latter.

Lever Brothers Co., Cambridge, Mass., has purchased John F. Jelke Co. of Chicago.

Tennessee Products and Chemical Corp., Chattanooga, has placed a contract with chemical plants division of Blaw-Knox Co. for engineering, procurement and installation of process equipment in the construction of a fine chemicals plant. Expected to be in operation by the spring of 1949, the plant will produce flake sodium benzoate, benzoic acid, benzaldehyde, benzyl chloride, benzol chloride, benzyl alcohol and hydrochloric acid.

Frontier Chemical Co., Midland, Tex., is increasing the current expansion program at its Denver City plant to produce 25,000 tons of 20 deg. Be. muriatic acid and 7500 tons of caustic soda annually.

Hewitt-Robins, Inc., New York, is occupying new executive and sales offices on the 18th floor at 370 Lexington Ave.

Ceco Steel Products Corp., Chicago, has moved its general offices to 5601 West 26th St.

H. H. Buggie & Co., Toledo, Ohio, has opened a new division to handle fabrication and modeling of silcone rubbers and resins. Edward A. Sprigg

EXPLOSION SAFE • EFFICIENT AGITATION



Interchemical Corp., Finishes Division uses PNEUMIX for efficient, explosion safe agitation of paint batches to secure desired tints. Light weight permits lifting Pneumix out of tank.

PNEUMIX AGITATORS are absolutely explosion proof. They're air powered by a motor that cannot overheat or burn out through stalling.

Speed is maintained by opening the air throttle. Too-fast operation is avoided when material thins by closing the throttle.

An added feature—an important feature is the light weight of **PNEUMIX AGITATORS**—making for easier handling from tank to tank in batch operations.

Get the whole Pneumix story. *Send for a copy of* "PNEUMIX IN ACTION." Write

ECLIPSE AIR BRUSH COMPANY, INC.
Park Ave. & 14th, Newark 7, N. J.

1801



PNEUMIX DIVISION
ECLIPSE



YOU GET

ALL THESE FEATURES

IN CHAPMAN STEEL VALVES

1 Valves with a high precision rating — a rating which *equals* or *exceeds* standard specifications.

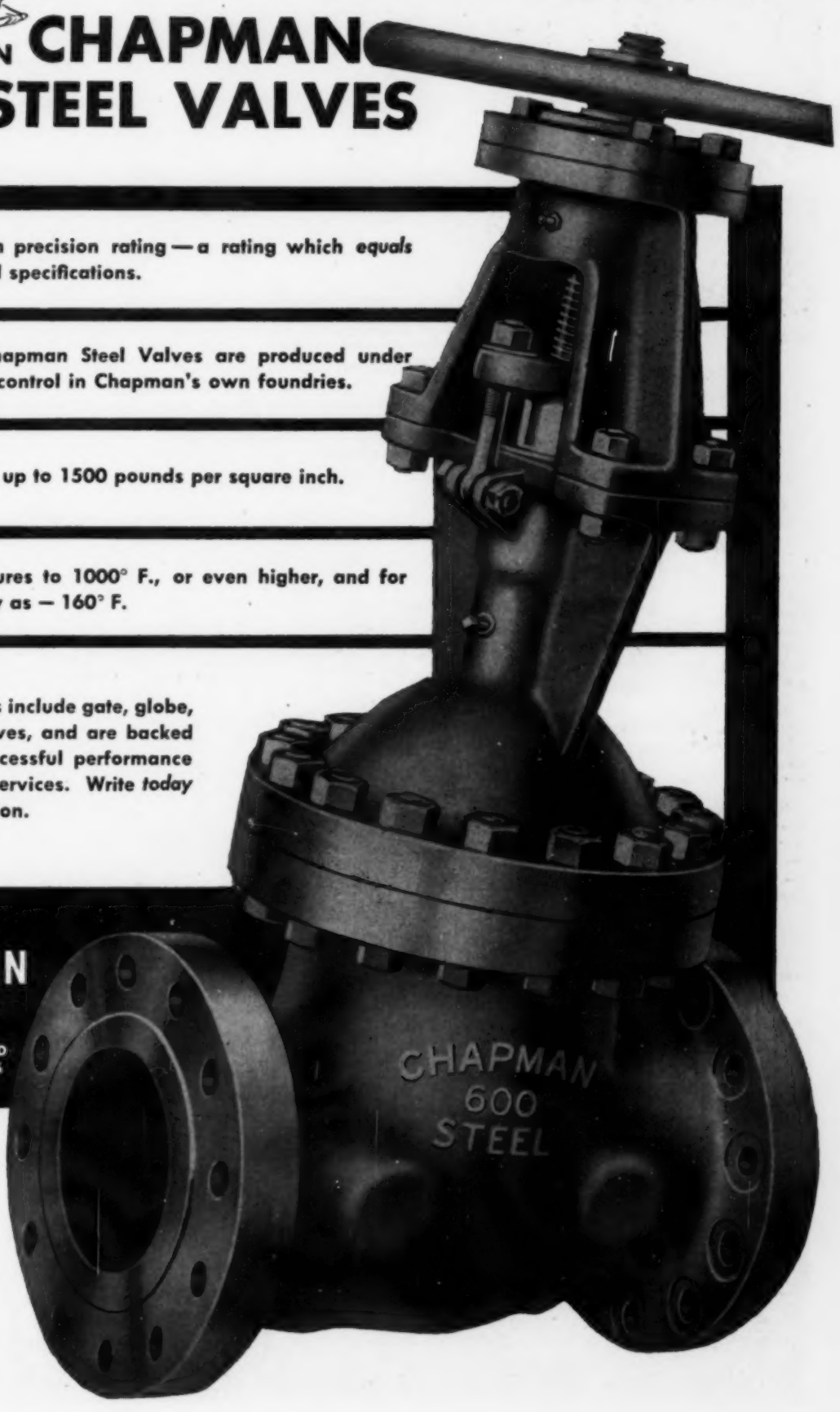
2 Metals used in Chapman Steel Valves are produced under strict metallurgical control in Chapman's own foundries.

3 Made for pressures up to 1500 pounds per square inch.

4 Made for temperatures to 1000° F., or even higher, and for temperatures as low as — 160° F.

Chapman Steel Valves include gate, globe, angle, and check valves, and are backed by long years of successful performance in even the severest services. *Write today* for complete information.

THE CHAPMAN VALVE MFG. COMPANY
INDIAN ORCHARD MASSACHUSETTS



9 out of 10 industries Need Bendix-Friez Wind Recorders for Smoke Abatement Installations

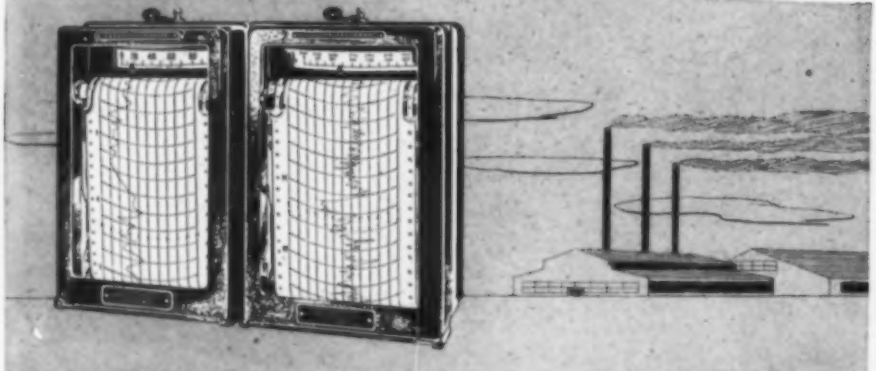
Equipment for smoke and fume control is not complete without permanent records of wind-speed and direction. Write us about Aerovane.*

*TRADE MARK

Aerodynamic transmitter is easy to install and modern in design.



Wind speed, wind direction permanently recorded indoors.



FRIEZ INSTRUMENT DIVISION
OF BENDIX AVIATION CORPORATION
Baltimore 4, Maryland

PRODUCT OF Bendix AVIATION CORPORATION

is general manager of this company which manufactures electrical connectors for radar, television and mobile communication equipment.

E. I. du Pont de Nemours & Co., Wilmington, has made Ernest R. Cathcart staff advisor to the fabrics division.

Babcock & Wilcox Tube Co., New York, has appointed Industrial Supplies, Ltd., Vancouver, as its exclusive sales agent for British Columbia, Canada.

General Ceramics and Steatite Corp., Keasbey, N. J., has appointed the D. D. Foster Co. of Pittsburgh as their representatives for western Pennsylvania, Ohio, and West Virginia.

Ferro Enamel Corp., Cleveland, has appointed G. L. Bruton assistant sales manager and E. C. Davidson manager.

Industrial Process Engineers, West New York, N. J., has appointed Raymond J. Selwyn as their Chicago district representative.

Infilco Inc., Chicago, has appointed Clyde H. Irwin as field engineer in charge of the Pittsburgh office.

Dow Chemical Co., Midland, Mich., has named five new members to its board of directors. They are: A. P. Beutel, C. A. Campbell, R. L. Curtis, C. A. Gerstacker and N. D. Griswold.

Oronite Chemical Co., San Francisco, has moved its executive and sales offices to new and larger headquarters at 38 Sansome St.

Chemical Corp. of Colorado, Denver, has opened a Chicago sales office at 201 North Wells St. Hyman Gold, divisional manager, has been placed in charge. Russell Ryland has been appointed divisional sales manager for the Oklahoma and Kansas area.

Givaudan-Delawanna, Inc., New York, has added to its sales management staff. J. H. R. Stephenson has been made Eastern sales manager and R. M. Stevenson, Midwestern sales manager with headquarters in Detroit. The appointments are effective October 1.

Bemis Bro. Bag Co., St. Louis, has closed its multiwall paper bag plant at St. Helens, Ore. They plan to open a new plant in Vancouver this month.

Gulf Refining Co., Cleveland, has been issued two city permits for petroleum stills, major units in their



STRETCH TEST STRENGTHENS SERVICE LIFE

Quaker Pre-Tested Products Assure Positive Performance

Pulling . . . stretching . . . breaking the fabric that goes into Quaker products is just one of the more than eighteen tests to produce top quality in every one of the 9001 carrying the Quaker trade-mark.

The tensile test shown above is to assure fabric for belts that will meet and beat the recommended horsepower transmission . . . hose that will withstand all pressures encountered under working conditions.

When you specify Quaker products, you are sure of peak performance—pre-tested in the laboratory and performance proved throughout industry. For higher plant efficiency and lower operating costs, call your nearest Quaker distributor. He and the Quaker sales engineer are teamed to provide accurate recommendations on belting, hose and packings.

QUAKER RUBBER CORPORATION

PHILADELPHIA 24, PA. • New York 7 • Cleveland 15 • Chicago 16 • Houston 1

Western Territory

QUAKER PACIFIC RUBBER CO. • San Francisco 5 • Los Angeles 21 • Seattle 4

Quaker Pre-Testing

OFFERS THE CHEMICAL INDUSTRY



BELTING FOR MAXIMUM HORSEPOWER TRANSMISSION

Huge flat belts driving large flywheels or small fractional horsepower drives on small motors . . . Quaker pre-testing develops belts for every need of the Chemical industry . . . belts to assure peak efficiency under all operating conditions.



HOSE THAT STANDS WEAR AND ABRASION

Hose for air, steam, water, oil, gas, fire or chemicals... Quaker makes it and makes it to fit the needs of the Chemical industry...each length of Quaker hose is made right . . . pre-testing assures peak performance.



PACKINGS FOR TIGHTER SEALS . . . LONGER WEAR

Quaker packings are scientifically engineered for every use—for pumps, refrigeration compressors, water lines, valves and the many other places in the Chemical industry. Each pre-tested for positive performance.

QUAKER RUBBER CORPORATION PHILADELPHIA, PA. QUALITY SINCE 1885

QUAKER RUBBER PRODUCTS

custom made for every industrial use

WILLIAMS

HEAVY DUTY CRUSHERS PULVERIZERS . . . SHREDDERS



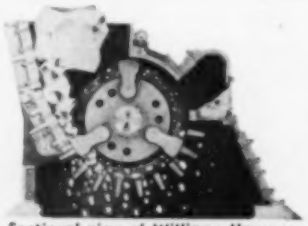
"SLUGGER" TYPE
CRUSHER
FOR CRUSHING CRUDE MATERIAL

Many successful installations attest their dependability and low operating cost

● No matter what the job requires, there is a standard Williams machine for the reduction requirements. Capacities range from 50 pounds to 300 tons per hour, permitting selection of exactly the proper size for your work.

The "Slugger" Type shown above is ideal for the primary reduction of crude ores, etc. Crushes by the Williams Hammer Principle, with rows of heavy, free swinging, fast revolving hammers crushing the material by impact until of proper size to pass through the grates. The ideal machine for the job.

We solicit your inquiries



Sectional view of Williams Hammer Crusher showing how the heavy, free swinging hammers reduce the material to desired size.

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 North Ninth St. St. Louis 6, Mo.

Sales Agencies Include

CHICAGO 5
37 W. Van Buren St.

NEW YORK 6
115 Broadway

PHILADELPHIA 2
15th & Market Sts.

$15,000,000 expansion program. Both structures are to be located on the Gulf property at 2935 Front St. One of the stills, with catalytic and cracking and recovery units, will cost $4,090,000. A smaller one will cost $793,000.

General Electric Co., Pittsfield, has appointed Roger W. Jackson district sales manager of the chemical department's East Central district with headquarters in Cleveland.

Food Machinery Corp., Los Angeles, has appointed E. E. Bauer manager of the Peerless Pump division central sales district located at 4554 North Broadway, Chicago, Ill. Frank W. McCann has been made centrifugal pump sectional sales manager.

Dow Chemical Co., Midland, Mich., has made J. C. H. Stearns manager of ingot sales, G. W. DeKuiper manager of wrought product sales, and T. H. Caldwell, Jr., manager of die castings sales in their magnesium division.

Koppers Co., Inc., Pittsburgh, has appointed Fred C. Foy vice president and manager of their sales department, central staff.

Kaye & MacDonald, Inc., West Orange, N. J., have purchased the Julian D'Este division of the American Chain & Cable Co.

Gordon, Kinney and Staninger, Inc., Chicago, Ill., a new firm in the materials handling field, is made up of Alex Gordon, James P. Kinney, and Carl Staninger.

Thomas C. Wilson, Inc., Long Island City, N. Y., has appointed five new sales representatives. They are: Steel & Engineering Products, El Paso, Tex.; Interstate Machinery and Supply Co., Omaha, Neb.; Plibrico Sales and Service Co., Charlotte, N. C.; Leinert Engineering Co., Knoxville, Tenn.; and Kiger Supply Co., Detroit, Mich.

Cincinnati Chemical Works, Inc., Cincinnati, has commissioned the Austin Co., to construct a two-story administration and research center on Laidlaw Ave., Bond Hill, Cincinnati.

Bemis Bro. Bag Co., St. Louis, has established a sales office in Cleveland, headed by Neely J. Leake.

St. Regis Paper Co., New York, has elected the following officers for its subsidiary, St. Regis Sales Corp.: Arch Carswell, executive vice president; H. W. Sloan, vice president and direc-

Simplify valve selection...

WITH THIS

LUNKENHEIMER

"RENEWO" THREESOME!

The "RENEWO" Threesome is fully described in Circular No. 577, which also explains the economy feature of converting one type to another by simply changing seat and disc. A copy is yours for the asking . . . from your Lunkenheimer Distributor or from us direct.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

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NEW YORK 13 CHICAGO 6

BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N.Y.



YOUR LUNKENHEIMER DISTRIBUTOR . . .

Provides Better Valve Service . . . Lunkenheimer Distributors are located in the principal industrial centers. There is one near you, fully equipped and ready at all times to assist with your maintenance and operation problems. Call on him.

1 REGULAR TYPE...



Fig. 73 200 lb. S.P.
Fig. 16 300 lb. S.P.

Regular "RENEWO": one of the most popular and widely used valves ever designed for general service. As the name clearly implies, all parts are renewable.

2 "P" TYPE...



Fig. 73-P 200 lb. S.P.
Fig. 16-P 300 lb. S.P.

"P" (Plug Type) "RENEWO": for throttling, drain, drip, water column blowdown and similar service. The "NS5" Nickel Alloy 330 Brinell seating material, developed and patented by Lunkenheimer, has exceptional wearing qualities and high corrosion resistance.

3 "PS" TYPE...



Fig. 73-PS 200 lb. S.P.
Fig. 16-PS 300 lb. S.P.

"PS" (Plug Type) "RENEWO": for maximum resistance to the effects of close throttling and other severe service, particularly where abrasive conditions are encountered. Equipped with stainless steel 500 Brinell seat and disc.

Don't sacrifice uniformity . . . for high tonnage reduction

GET *BOTH* . . .



WITH AN

AMERICAN CRUSHER!

The new American Type "ACS" for crushing operations demanding a capacity up to 250 T.P.H. Sectional construction permits easy dismantling and relocation.

Rugged Americans thrive on tough, exacting crushing requirements—they're custom-built to give the best possible performance for the job at hand. One important reason why the chemical industry has learned to depend on Americans for high output *and* uniformity—regardless of their reduction problems.

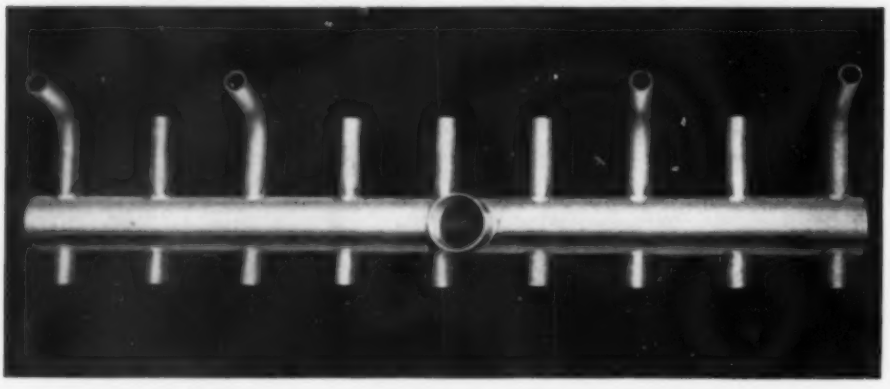
- Easily adjusted externally for a wide variety of friable and fibrous materials.
- Takes wet or dry, hard or soft materials right in stride.
- Uniform reduction at high output ratings —5 to 250 TPH.
- Readily accessible for easy, quick cleaning.
- Five different impactors in rolling rings, shredder rings, or swing hammers—for the reduction action you need.

Send for latest descriptive literature.

American PULVERIZER COMPANY

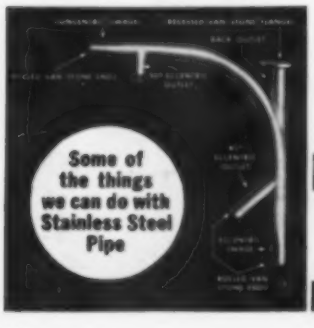
Originators and Manufacturers of Rivo Crushers and Pulverizers

1219 Macklind Ave.
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Stainless Pipe Pre-fabricated by Pioneer Specialists

Fifteen years ago, we pioneered in developing methods for welding and shop pre-fabrication of stainless steel piping. Today, we use the latest "inert-gas-shielded-arc" welding, which has only recently become commercially available. Photo above shows one of fifty headers recently completed, all alike and each to very exacting tolerances. Curved sections were heat treated to very rigid specifications, after bending, then pickled, passivated and re-checked. Insides of welded joints were made absolutely smooth. No job is too large or too small for our facilities and none too difficult for our engineering experience. . . . Most utilities and large industrial plants know the perfection of our patented Westport Welded Joint and our high pressure, high temperature pipe engineering and pre-fabrication, for we have been in this business for 49 years. Write us, or send your prints for an estimate.



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tor; John F. Gruber and Walter M. Neill, vice presidents.

Joseph Turner & Co., Ridgefield, N. J., has appointed John F. Henry acting director of sales for the east on all chemical items.

Philadelphia Quartz Co., Philadelphia, moved their general offices to the Public Ledger Bldg., Independence Square, on August 2.

Kramer Trenton Co., Trenton, N. J., has appointed Thorpe A. Mayes, Jr., as its representative covering the South Central area of the United States.

Food Machinery Corp., San Jose, Calif., has made Hubert L. Byrd manager of their John Bean division at Lansing, Mich. G. C. Jones has been made assistant of the Bean-Cutler division and Howard L. Shannon has been transferred to Florida as manager of the Florida division.

Link-Belt Co., Chicago, Ill., has given Vivrett & Vivrett the contract for the construction of a new plant on a 10-acre plot of ground in the 5100 block of Wayside Drive in Houston, Tex.

Napko Paint & Varnish Works, Houston, Tex., has made William G. Mengel head of their expanded industrial technical service department.

Moreland Chemical Co., Spartanburg, S. C., has added Joseph J. Blake to their staff to cover the Carolinas.

Lion Oil Co., El Dorado, Ark., has re-elected its entire board of directors. Officers elected were: T. H. Barton, chairman of the board; T. M. Martin, president; A. F. Reed, vice president; J. E. Howell, vice president; R. E. Meinert, vice president; C. N. Barton, vice president; Jeff Davis, secretary; E. W. Atkinson, treasurer.

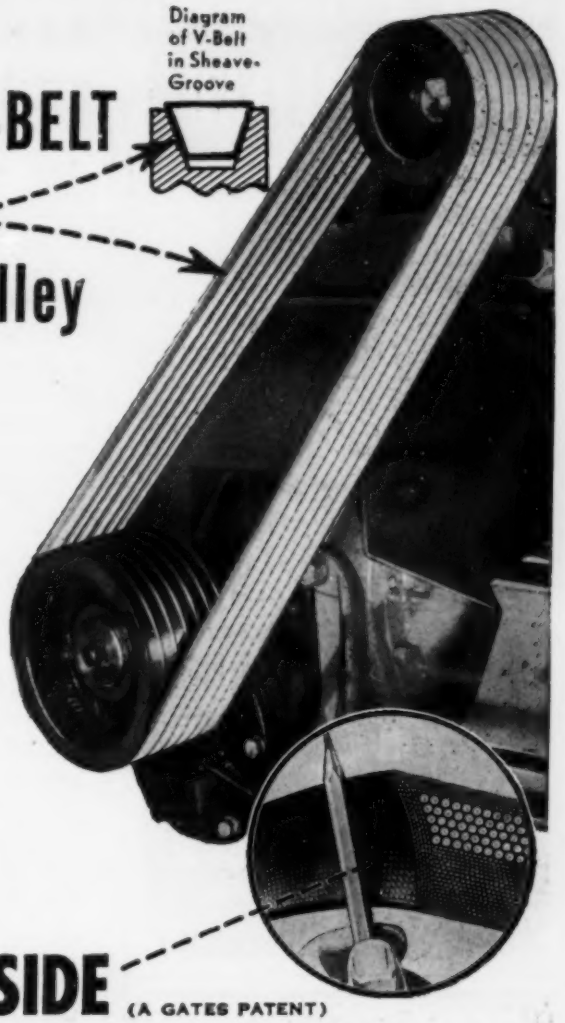
American Anode, Inc., Akron, has just opened a new development laboratory at Akron.

Traylor Engineering and Mfg. Co., Allentown, Pa., has elected W. J. Roberts, Sr., president for the 31st time. W. C. MacDowell retired as vice president in charge of sales.

Bailey Meter Co., Cleveland, has opened a new branch office in Charlotte, N. C. J. R. Powell has been appointed branch manager.

Atlantic Refining Co., Philadelphia, has opened a sales office of its chemical products division in Chicago, Ill., located in the Chicago Title and Trust Building, 111 West Washington St.

The SIDE of a V-BELT is what GRIPS the pulley



Naturally, it GETS the WEAR!

Any one familiar with V-Belt drives knows that the sides of a V-Belt are what really get the wear.

It's the *sides* that grip the pulley. They *pick up* all the power from the driver pulley, *transmit* that power to the belt as a whole and then, once more, they *deliver* the power to the driven pulley. And, clearly, it's the *sides*—and *only* the sides—that take the wear against the sheave-groove wall.

That is why you have always noticed that the *sidewall* of the *ordinary* V-Belt is the part that *wears out first*—and, naturally, if you prolong the life of the sidewall, you *lengthen* the *life* of the *belt!*

Now See How the CONCAVE SIDE (A GATES PATENT) SAVES Sidewall Wear and Lengthens Belt Life!



The simple diagrams on the left show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. The diagrams show also why the Patented Concave Side greatly *lengthens the life* of the *sidewalls* of Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belt can possibly give.

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Now that Gates *SPECIALIZED* Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

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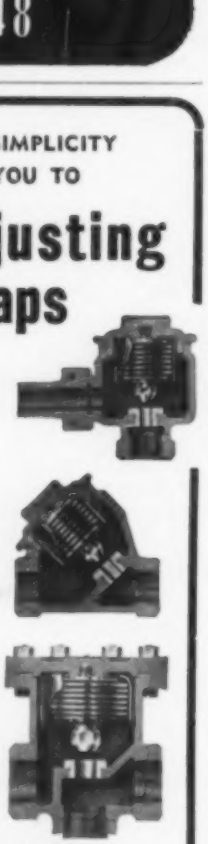


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CONVENTION PAPER ABSTRACTS

CONTENTS

You May Have 7 Lb. 260
0.0000146 260
Remote Control Engineering ... 260
Plastics Prospects 262
How Undergraduates Are Hired. 264
Temperature-Resistant Rubber .. 266
Preparation and Uses of Fluorothene 266
An Old Industry 268
Peroxide Catalysts 270
Wooden Beefsteak 272

You May Have 7 Lb.

SINCE the end of World War II, the capacity of the industry to produce almost all raw materials has been more than doubled, based on rated capacity in 1941. Last year 849 million pounds of plastic raw materials were actually consumed, and the ability of the industry to produce is in excess of 1 billion pounds per year. Since the end of the war somewhere in the neighborhood of $175 millions have been spent by the plastics industry for the building and equipping of new facilities. How many additional millions have been spent by molders, laminators and fabricators is not a matter of record, but is undoubtedly tremendous.

A few simple computations reveal that every man, woman and child in the United States must use approximately ½ lb. cellulose acetate and butyrate, ⅛ lb. cellulose nitrate, 2½ lb. phenolics, ½ lb. urea and melamine, ¾ lb. polystyrene, 1½ lb. vinyls, ¾ lb. miscellaneous molding compounds and resins, or a total of about 7 lb. of plastics per person, to consume the 849 million pounds produced in 1947.

C. J. Romieux, American Cyanamid Co., before Pacific Coast Section, Society of the Plastics Industry, Santa Barbara, March 29-31, 1948.

0.0000146

EARLY in the work of the Manhattan Project, the physical properties of the gas uranium hexafluoride were needed in order that certain calculations could proceed with assurance. In the case of the thermal conductivity of the gas, the value which had previously been measured directly disagreed with that which had been calculated from another physical property, the viscosity.

Thermal conductivity of a gas is a measure of its ability to carry heat from one surface to another, and it is usually determined by heating a wire electrically to a given temperature in a cell filled with the gas. If the walls of the cell are maintained at a constant temperature and the electrical energy required to heat the wire to a slightly higher temperature is known, the constants for the thermal conductivity can be found. Precise electrical measurements and precise temperature controls are required.

Due to the corrosive nature of the experimental material it was necessary to use a simple all-metal cell. At first the characteristics of the cell changed rapidly. Eventually the changes become slow enough to make possible precise comparisons with other gases which were well known, and the thermal conductivity of the uranium hexafluoride was obtained by a graphical comparison with the known values of the standardization gases.

The value of the thermal conductivity obtained as described above the direct measurement is also the value calculated from new measurements of the viscosity of the gas. The value of the physical constant thus confirmed is, at 0 deg. C., 0.0000146 calories per sq. cm. per cm. per deg.

P. A. Agron, Alexander Rug Co., and A. H. Taylor, Columbia University, before Division of Physical and Inorganic Chemistry, American Chemical Society, Chicago, April 19, 1948.

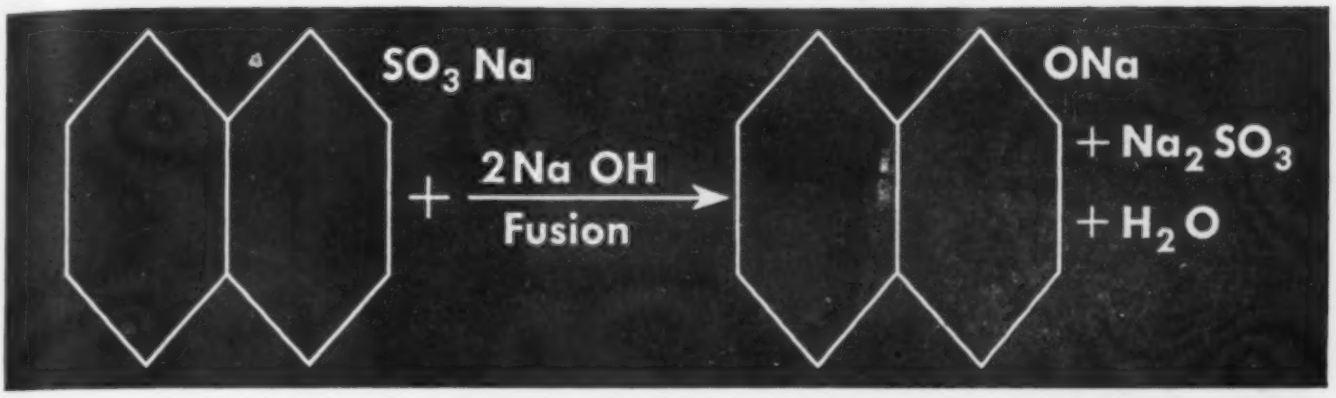
Remote Control Engineering

THERE is hardly any research today involving nuclear science which does not involve remote control operations to some extent.

Perhaps it is a simple operation such as transferring a radioactive sample from a lead pot to an improvised shielded area by means of a set of long tongs. The activity may not be large, but, if spilled, might enter the human body through a cut, via the air, or orally, and ultimately cause serious radiation damage. Less seriously, the accident might contaminate valuable apparatus and thus slow up or prevent completion of the research. It is obvious that the tongs used for this simple 'hot' operation must have properties not required in, say, foundry tongs.

The ultimate design for a building or room in which high levels of radioactivity are to be handled would be a completely enclosed and heavily shielded structure in which many operations could be carried out by remote control. In addition, one has the problem of viewing operations inside such a structure. No really satis-

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For these reasons, users of caustic fusion processes have followed the lead of caustic soda producers—and turned to Nickel and Inconel* as materials for processing equipment.

Continuous processing, whether to produce anhydrous caustic, or in a caustic fusion process, may make severe demands on equipment. The combination of properties available in Nickel and Inconel recommend them for these continuous units. Both show high corrosion resistance to hot caustic and commonly encountered organic chemicals.

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As a result of recent investigation, Inconel has proved to be of significant value for certain applications involving hot caustic soda. If you would like full information on these recent findings, write now to our Corrosion Engineering Service.

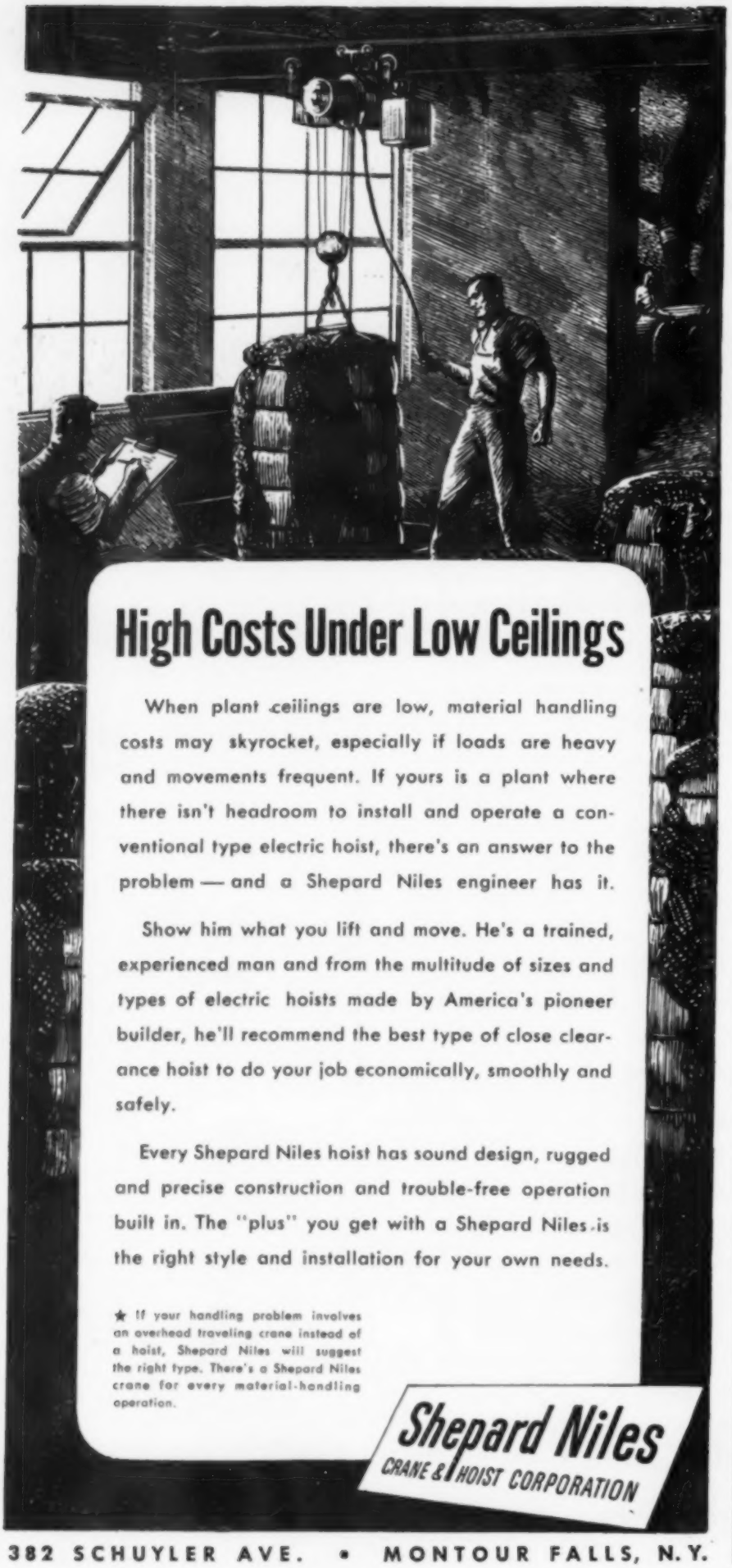
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factory method has as yet been worked out. Television, periscopes, mirrors, high density transparent solutions—all have been used with varying degrees of success.

Some of the remote control devices already in use are several types of tongs, small over-the-wall hand manipulators, periscopes, a vertical can opener, remote control gages, drilling devices and a synchro operated syringe.

No program in the development of remote control engineering has yet been set up which will even approximate the needs of the research worker in atomic energy now and in the future. Scientists will want to handle ever-increasing amounts of radioactivity and to do ever-increasingly difficult experiments with radioactive materials. The urge to produce an automaton should no longer be for spectacular exhibitions only, but for very practical needs. The speed with which nuclear research goes on will, in the future, depend on the speed in the development of remote control engineering. Certainly this field is at the present time only in its infancy—if it has really been born.

O. C. Simpson, Argonne National Laboratory, before American Society of Mechanical Engineers, Milwaukee, June 1, 1948.

Plastics Prospects

Continuing high levels of production of thermosetting molding materials are possible. Expansion plans of the material manufacturers are now substantially completed to the point that production levels at a rate of 12 percent above the 1947 total are now being maintained; production of thermosetting molding materials in 1947 was estimated at 236 million pounds.

This production, now at a new high for the industry, is meeting practically all requirements and in all probability these levels can be increased somewhat in 1948. Based on the present requirements, there is no prospect of shortages and there is every indication that the industry is now entering into a buyer's market for molding material.

Additional facilities for manufacture of methanol and formaldehyde have or will shortly do away with any shortages for these basic chemicals. New facilities for the manufacture of urea will come into production in the last half of the year at which time it is expected full production of amino molding materials will be possible. Phenol production in 1948 is already operating at a rate somewhat above the 1947 average and a limited increase in production will be made in the third quarter. However, no sub-



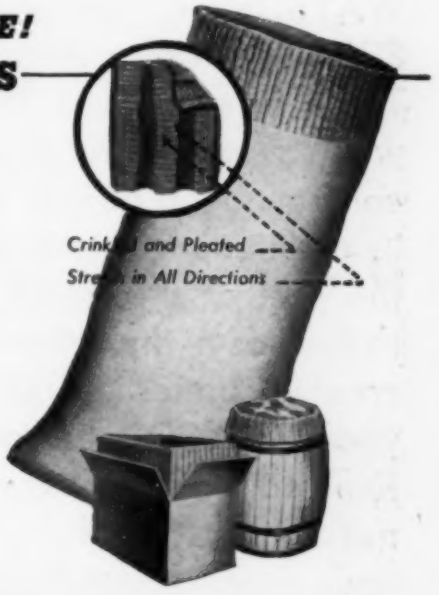
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stantial increase in phenol is believed possible or probable before 1950.

Production capacity for thermosetting molding materials is now believed to be ample and somewhat in excess of basic chemicals now available. If raw materials were available, 1947 production could be exceeded by 50 percent.

F. H. Carman, Plastics Materials Manufacturers Association, before Society of the Plastics Industry, May 21, 1948.

How Undergraduates Are Hired

For years our program with respect to new personnel has been based on hiring young men capable of advancing to responsible positions. Experience has shown that the best procedure for our purpose is, first, to conduct individual interviews of 15 to 35 min. at the school. We then invite these men in whom our departments are interested to visit one or more locations for further interviews.

The important thing to remember is that such items as a student's general appearance, his speech and manner, are important only insofar as they enter into the primary factors to be discussed later. We try to understand what these traits and surface indications mean as part of the whole man. Barring gross abnormalities, physical characteristics are important only as they may affect the individual possessing them.

When considering a man for a job we try to explore three broad factors: professional competence, personal qualifications and leadership abilities.

Professional competence is indicated by such clues as scholastic standing, ability in self-expression, a man's breadth of interest in his field and the ability to observe accurately and report facts. With respect to scholastic standing, many people will always regard scholastic attainment as indicating a man's ability to bring his best to bear on a problem. If a student has permitted himself to be drawn away from the principal objective of getting an education and has established a poor or mediocre record, is it reasonable to suppose he can resist distractions from his work after taking a position in industry?

In the realm of personal qualifications we concern ourselves most with eight variables: moral character, motivation, practical intelligence, emotional stability, maturity, social capacity, energy, and general health. During college days men vary with respect to these points, but we are convinced that everyone can improve himself in such matters through guidance, self-analysis and self-discipline.

With respect to leadership abilities these are essential if a man is to rise to

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1½" hollow core runs full length of blade.

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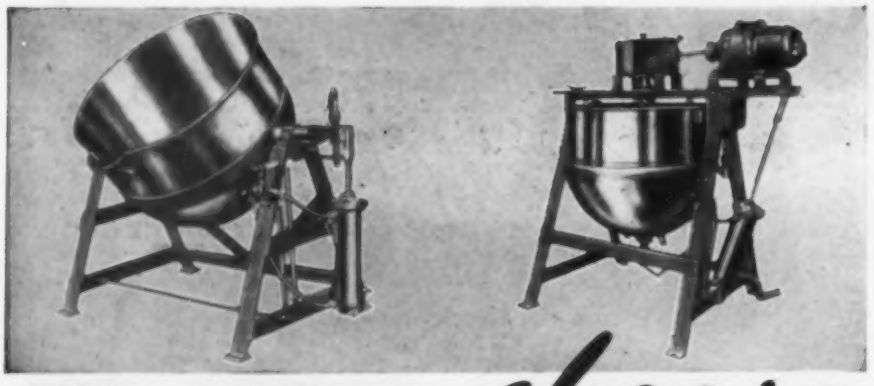
The 7'6" Stainless Steel sigma blade illustrated weighed 1550 pounds and was cast for use in the basic manufacture of plastic. A 1½" hollow core runs its full length to enable constant cooling or heating of the blade by the flow of water or steam. Agitators cast of Stainless Steel are ideally suited for use in the process industries because of their corrosion resisting characteristics, ease of cleansing and high surface lustre. Cooper Alloy has cast agitators of all sizes and types, from a few ounces to many tons. Consult our Engineering Department with your casting problems. In addition to producing castings, Cooper manufactures a complete line of Stainless Steel Pipe Fittings, Accessories and Valves. Monthly Inventory Stock List now available upon request.

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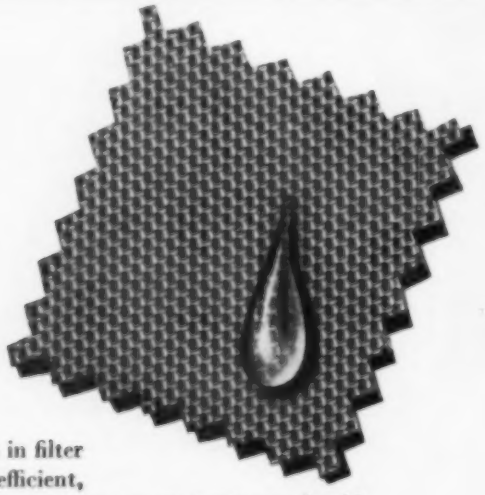
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a position of responsibility. During college days a man's diversity of interests, school positions won, organization work and similar activities indicate in some measure his potentialities as a leader able to inspire and direct others.

G. L. Bussard, E. I. du Pont de Nemours & Co., before American Society for Engineering Education, Austin, Tex., June 14-18, 1948.

Temperature-Resistant Rubber

SPECIAL problems in processing Silastic rubber are its tendency to stick to steel rolls and its relatively long curing time. The material may be formed in conventional heated presses to give it shape, then oven baked to cure. The amount of cure required depends upon the type of rubber and use of the final product. Many special applications, recently in the automotive field, arise from its resistance to high temperature. Samples recently produced are elastic at extremely low (−150 deg. F.), and extremely high temperature (500 deg. F.). A piece chilled to dry ice temperature is still flexible, whereas a comparative piece of organic rubber is quite brittle.

W. A. Wiard, Dow Corning, before Knoxville-Oak Ridge Section, American Institute of Chemical Engineers, Knoxville, May 22, 1948.

Preparation and Uses of Fluorothene

FLUOROTHENE, a polymer of trifluoromonochloroethylene, is derived from the reaction in an autoclave of trifluoromonochloroethane and zinc in an ethyl alcohol medium. This reaction, necessarily carried out under low temperature conditions, produces the low boiling monomer which is then passed through two distillation columns to separate unreacted raw materials and products of side reactions, yielding pure monomer. Useful byproducts such as fluorocarbon oils and wax are obtained from the distillation step. Cylindrical containers or reactors filled with the monomer are placed in a bath which causes polymerization of the reactor contents. Finally excess monomer is evacuated and the solid product extracted from the reactors ready for fabrication procedures. Development of the manufacturing process included many safety considerations as the monomer is extremely volatile and toxic requiring a very tight system.

Fluorothene is "completely chemically resistant." It is unaffected by concentrated acids or alkalis. It can be swelled by some chlorocarbons. It is not recommended for use under temperature conditions above 300

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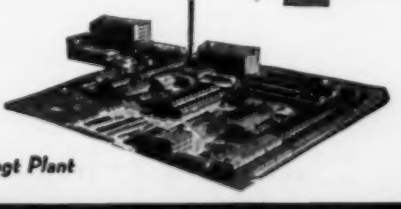




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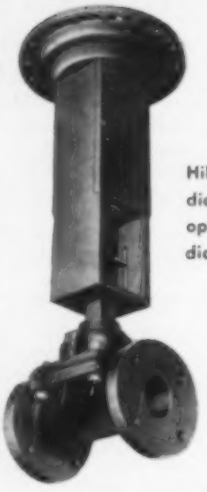
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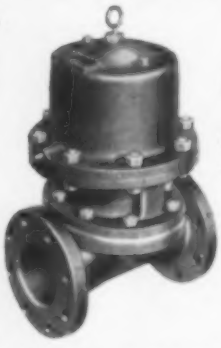
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deg. F. The material can be made hard by slow cooling or soft simply by quenching. It is harder than polytetrafluoroethylene. Its electrical properties compare favorably with other plastics such as polystyrene.

To date fluorothene has successfully been used for making valve seats, gaskets, unbreakable beakers, inert pigmented products, flowmeter bobs, separatory funnels with stop cocks lubricated with fluorocarbon wax, etc. Sheet stock has a slight haze. Fluorothene can be used for extrusion or injection molding, and stock forms have good machining qualities. Future uses many include filter cloth, tank linings, pipe linings, and sheet materials. Byproduct fluorocarbon oils are now used in diffusion pumps, for lubrication, and for manometer fluid.

S. H. Smiley, Carbide and Carbon Chemicals Corp., before Knoxville-Oak Ridge Section, American Institute of Chemical Engineers, Knoxville, May 22, 1948.

An Old Industry

THE wood-distillation industry in the United States is faced with the twin problems of diminishing supplies of raw materials and dwindling markets for its products. Despite the use of additional species of wood, made possible through continuing research, it has become increasingly difficult to supply the plants with raw material at a price that will permit profitable operation.

Supply of raw material through the course of years has determined both the location of the plants and the products that they manufacture. In consequence, although similar carbonization methods are employed, the industry is divided into branches; one for the distillation of hardwoods, the other of resinous woods.

Principal marketable products of the hardwood-distillation industry are acetic acid, methanol and charcoal. The quantities of acetic acid and methanol produced by both types of plants are largely incidental to the manufacture of charcoal and are relatively unimportant commercially. The present status of the hardwood distillation industry is best shown perhaps by the better position of the plants now in existence to produce competitively. This has been achieved, in part through improved processing facilities of these plants, and in part through diminished production of the industry as a whole. The end result appears to be greater stability. Whether this apparent stability of the industry continues will be largely determined by further developments in these two directions.

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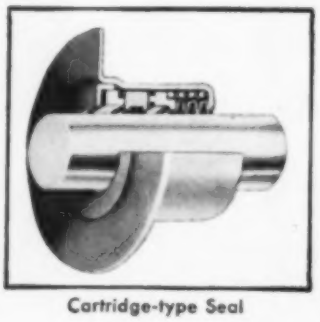


New Cartridge Seal Solves Rotating Shaft Sealing Problems

Stepped-up efficiency in sealing of rotating shafts can now be accomplished with a new Cartridge-type Seal mounted on the shaft.

The Cartridge-type Seal shown above is mounted within a Tuthill Pump. The seal contains all parts in one housing cup and insures positive double sealing. A high grade permanent lubricant is contained within the inside chamber of the housing.

Surfaces within the Cartridge-type Seal are lapped flat to within a few millionths of an inch to insure perfect mating. And, being a complete unit, only one mounting face is necessary. Clamps are eliminated, and adjustments or alignments are not required. Simply push the Cartridge-type Seal onto the shaft, tighten mounting screws and that's all.



Cartridge-type Seal

Just as new engineering developments increase efficiency and performance, so can workers' efficiency be increased through the use of chewing gum. The act of chewing helps relieve nervous tension, thus helping to make the work go smoother and easier. That's why plant owners everywhere more and more are making Wrigley's Spearmint Chewing Gum available to all.



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AC-71

tillation of resinous wood are chiefly turpentine, pine tar, pine oil, a dipentene fraction, and to a less extent, various types of solvent, wood-treating, and specialty oils. Resinous wood processing is similar to that employed for hardwoods with initial carbonization and subsequent refining procedures. With the exception of two plants, one of which recovers the crude oil as a basic product and one as a light oil and pine-tar fraction, it is current practice to refine further and obtain additional products. These include turpentine, pine oil, and dipentene from the lighter cuts, together with "solvent" and tar oils, as the refining facilities of the plants permit. Pine-tar wood preservatives are also produced at a number of plants.

Charcoal is obtained in about the same bulk amounts per cord of resinous wood as from hardwood distillation and its immediate sale, as in the latter industry, is equally important for profitable operation.

E. Beglinger, Forest Products Laboratory, before Forest Products Research Society, Chicago, March 22-24, 1948.

Peroxide Catalysts

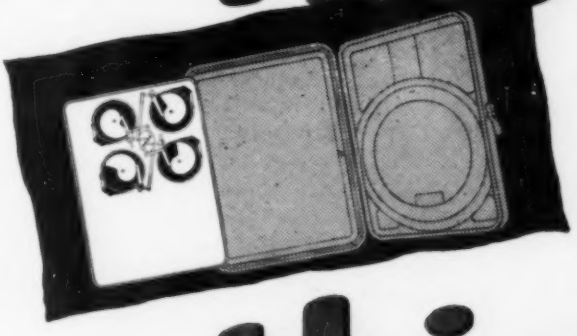
INCREASING use of polyester resins in laminating and casting operations by the plastics industry has stimulated the development of improved resin formulations and improved techniques to meet the changing problems of production and economics. This in turn, has resulted in a rising interest in organic peroxides in general, as necessary catalysts for these resins, and considerable attention has been focused on the application of the alkyl hydroperoxides and peresters in this connection.

Peroxides now manufactured in quantity include three alkyl peroxides and two peresters. They range in available oxygen content from 8.2 to 12.1 percent, and are soluble in or miscible with all of the polyester resins. Three of them are liquid, which is a desirable advantage to the fabricator in handling and mixing. Although all are exceptionally stable and may be stored for long periods without deterioration, they may present the usual hazards if used indiscriminately or handled carelessly.

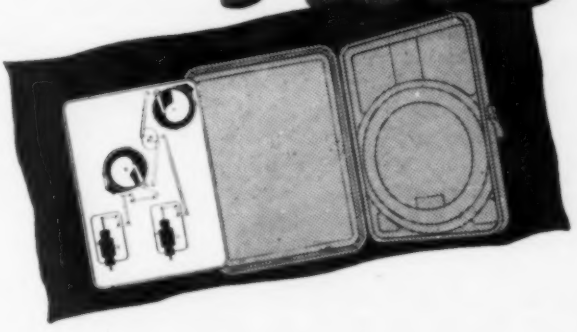
At the moment, interest centers around 60 percent t-butyl hydroperoxide, t-butyl perbenzoate, and 1-hydroxycyclobexyl-hydroperoxide-1. These have become established as recommended catalysts for polyester work, in many instances.

Despite promising results, these alkyl hydroperoxides and peresters are

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Fig. F-80

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not the magic panacea guaranteed to eliminate all catalyst difficulties. They will not make obsolete all other existing catalysts. Instead, we consider them as supplements or additions to the growing list of these materials. Each lends individual characteristics to the finished product. Each fills a specific requirement of the industry. From additional research and evaluation of these peroxides and others which are still in the laboratory, we hope to learn a great deal more about polyester catalysis, and as a result, eventually to make available to the plastics fabricators as well as to the resin manufacturer, an ever increasing number of better, lower cost catalysts with even wider ranges of usefulness.

R. P. Perry and K. P. Seltzer, Union Bay State Chemical Co., before Pacific Coast Section, Society of the Plastics Industry, Santa Barbara, March 29-31, 1948.

Wooden Beefsteak

FEEDING of blackstrap and beet molasses has set a precedent for feeding highly concentrated sugar solution to cattle, sheep, hogs, horses, and chickens.

In order to evaluate molasses produced from various species of American wood and to obtain information on palatability and the nutritional value of wood-sugar molasses, the Forest Products Laboratory is preparing molasses in its experimental pilot plant at Madison, Wis., to be used in feeding tests throughout the country by Agricultural Experiment Stations.

The process used at the laboratory consists of hogging wood residue to a size that is easily treated. Sawdust and shavings may be mixed with the hogged wood. The laboratory hydrolyzer holds 325 to 400 lb. of wood residue (dry basis). In most cases the wood residue contains from 10 to 50 percent bark and, therefore, the actual wood substance in the hydrolyzer is reduced by that amount. The chips are heated by the introduction of steam until the pressure reaches 50 lb., when dilute sulphuric acid is introduced continuously at the top and allowed to trickle down through the charge for conversion of the cellulose to sugar and extraction of the sugar. The solution containing the sugar is removed continuously from the bottom.

During the process, the steam pressure is gradually raised to 150 lb. in order to hydrolyze the more resistant cellulose. The solution coming from the hydrolyzer is treated with lime to remove the acid, is filtered, and then evaporated to a 50 percent sugar solution in an efficient evaporator. A

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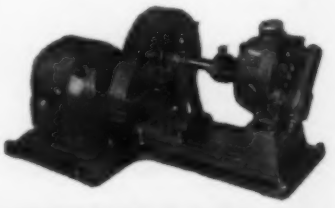
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These are only the highlights on this work-horse tube. All of the facts are yours for the asking. Call on Trentweld engineers, without obligation, for specific information, or write for the Trentweld Data Bulletin.

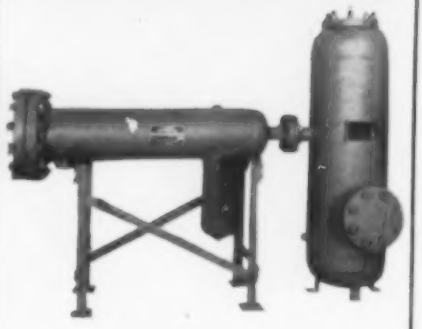
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E. T. Harris, Forest Products Laboratory, before Forest Products Research Society, Chicago, March 22-24, 1948.

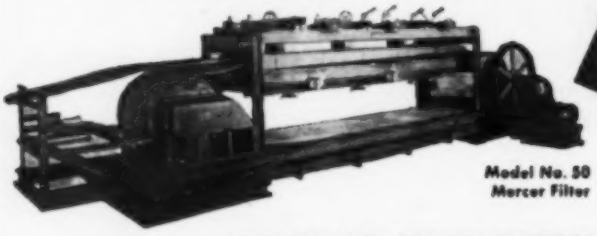
FOREIGN LITERATURE ABSTRACTS

Polymerization of Dimethacryl Ether of Ethylene Glycol

TRIMERIC polymers formed by polymerization of polyethelene compounds have been attracting more and more attention in recent years since this type of resin has high thermostability, infusibility and resistance to the action of various reagents. These trimeric polymers can be said to compete with thermoreactive polycondensates since they have a number of important technological advantages as compared with the different types of resol resins in use at present. Work was therefore carried out to develop methods of preparation and to study the mechanism of polymerization and the properties of the polymers of various acryl and methacryl and mixed allylmethacryl ethers of polyatomic alcohols, since these ethers should have a considerable tendency to trimeric polymerization and copolymerization. Polymerization of dimethacrylether of ethylene glycol in the condensed phase was studied by measuring the volume. It was found that the polymerization of this ether is not accompanied by increase of viscosity and by change in the index of refraction of the liquid part of the reaction mass, since in this case the insoluble gel is already formed in the first stages of the reaction. Polymerization of this ether takes place much more quickly in solutions of the monomer which seems to be due to the fact that part of the monomer is absorbed by the gel during block polymerization. On copolymerization of glycoldimethacrylate with methylmethacrylate increase in viscosity and index of refraction due to formation of the B-copolymer is observed only when the quantity of the polyfunctional monomer does not exceed 0.1 percent of the total

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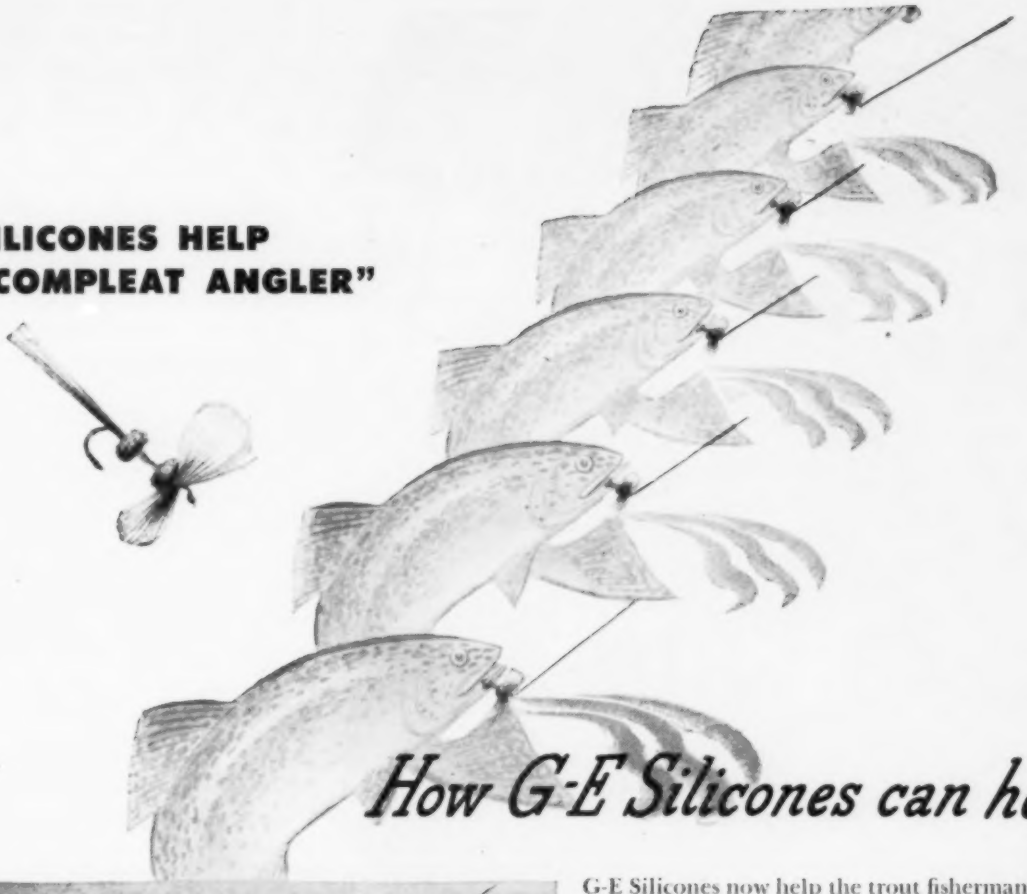
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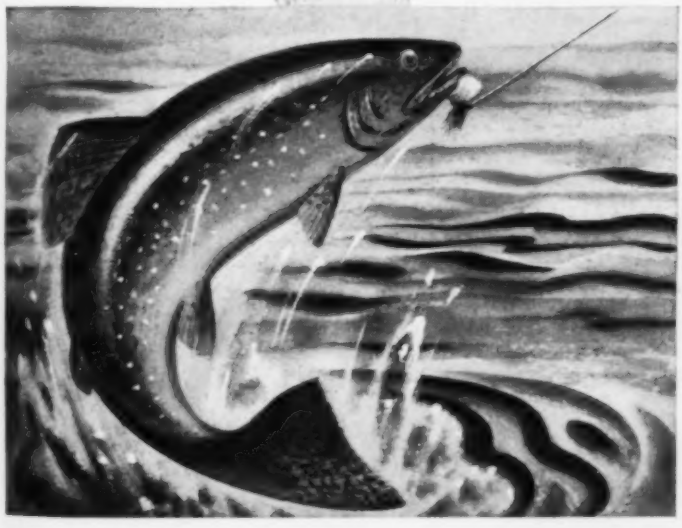
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methylmethacrylate. Increase of the quantity of polyfunctional monomer in the mixture leads not only to a change in the type of polymer but also increases considerably the period of induction.

Digest from "Investigation in the Field of Chemistry and Technology of Synthetic High-Molecular Compounds. A study of the Polymerization of Dimethacryl Ether of Ethylene Glycol" by A. A. Berlin and I. F. Bogdanov, *Zhurnal Obshchei Khimii* XVII, No. 9, 1699-1705, 1947. (Published in Russia).

Vulcanization to Ebonite

EBONITE (hard rubber) parts can be prepared by vulcanizing them in molds under pressure. This method results in high-quality products, accuracy of dimensions, much better surface of the parts and a higher electric strength than is obtained by the kettle method of vulcanization in steam, but it is not as widely used as it could be, since it is not as suitable for mass production as methods involving vulcanization of parts in presses and kettles. A method has been proposed for the rapid and complete vulcanization of ebonite parts in presses which involves the selection of a suitable mixture of ingredients and conditions which will permit rapid vulcanization (and therefore increased capacity) without affecting the quality of the product adversely. Essentially, this method depends on the composite action of accelerators and heat of vulcanization. Vulcanization to ebonite can be regarded as a typical self-accelerating reaction (due to the generated heat) in the intermediate and latter stages. The accelerators give the vulcanization a sufficient start in the beginning when the temperature is low. This method has been used successfully for 2 years and has resulted in improved quality and strength of insulator parts made from hard rubber. Moreover, there was a total economy of up to 1 million rubles per year on materials, power and labor.

Digest from "Rapid Method of Vulcanization to Ebonite", Report No. 1, by A. D. Stepukhovich, *Zhurnal Prikladnoi Khimii* XX, No. 1-2, 110-114, 1947. Published in Russia.

Lixiviation of Copper Minerals

MOST of the copper production of Chile is from a few large mines yielding low-assay minerals, while many smaller deposits are neglected for lack of economical processes for treating the ores. These ores are usually mixtures of oxidized and sulphide minerals, which makes their treatment complicated, but even in the case of pure oxidized minerals lixiviation with sulphuric acid is not economical due

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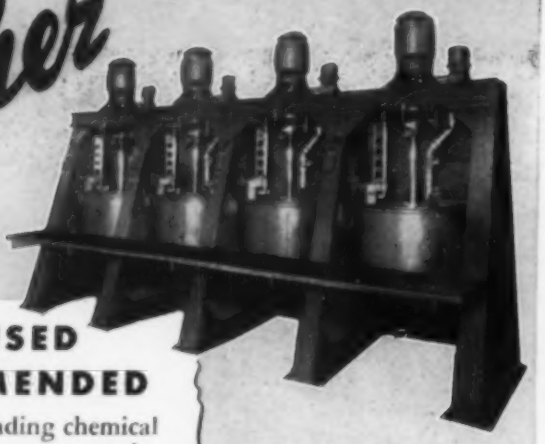


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to the presence of large quantities of carbonates. There are also large quantities of residues from flotation of sulphide minerals containing small percentages of copper in the form of oxidized minerals which also contain alkaline gangues. A number of methods have been proposed for overcoming these difficulties but none of them has met with success in industrial use. Work was therefore done on the possibility of leaching copper minerals which contain oxidized copper compounds, silicates and even sulphides, with solutions of ammonium carbonate which contain free ammonia. The silicates, of course, can be removed by reduction roasting of the material at about 300 deg. C. Products which also contain sulphides require a preliminary oxidation roasting at a minimum temperature of 450 deg. C. followed by a reduction roasting at 300 deg. C. After this treatment, practically all the copper present in the minerals can be recovered by lixiviation with the above solvent. Losses of ammonia can be reduced to a minimum by working in hermetically sealed containers and removing the part absorbed by the residue from the lixiviation by means of steam. Solutions can be obtained which contain up to 30 kg. of copper per cubic meter from which a mixture of very pure copper carbonate and hydrate is precipitated, which contains 53 percent copper when dried in air.

Digest from "Lixiviation of Copper Minerals by means of Solutions of Ammonium Carbonate and Ammonia" by L. Brunner and P. Krassa, *Industria Minera* 43, 46-50, 1947. (Published in Argentina).

Passivity of Unoxidizable Steels

PASSIVITY of unoxidizable steels of the type containing 18 percent chromium and 10 percent nickel or manganese can be increased considerably by subjecting them to a sensitization treatment by uniform acid corrosion prior to the oxidizing treatment of passivation. Passivation is preferably conducted in a solution of 10 percent nitric acid and sensitization in a fluonitric solution. Sensitization is effective whether the metal is sanded, annealed or cold-worked. It permits or accelerates spontaneous passivation in not very corrosive acid mediums and gives the metal a perfectly stable passivity in a very strong acid. Passivity of unoxidizable steels is due to phenomena of adsorption, the latter being of a physical nature in the absence of sensitization, and of a chemical nature when accompanied by it.

Digest from "Passivity of Unoxidizable Steels and Adsorption Phenomena", by Louis Guitton, *Comptes rendus des seances de l'Academie des Sciences* 226, 805-807, 1948. (Published in France).

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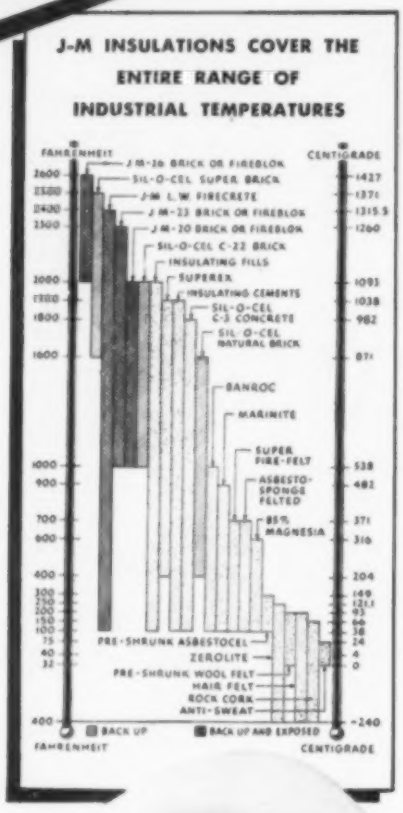
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Fresh Approach

1948 MODERN PLASTICS ENCYCLOPEDIA. *Breskin Publications, New York. 1,667 pages. $8.50.*

Reviewed by Roger Williams, Jr.



1948 Edition

THE GROWTH of the plastics industry in recent years needs no retelling. The Modern Plastics Encyclopedia has grown along with the industry. It has grown in weight, but more than that in stature. It would seem that there could be little new material to make this year's edition much different from last year's, but the volatility of the plastics industry provides material for a fresh approach.

Chemical engineers who are connected with plastics or chemicals that are used along with plastics know the book's value from previous editions. Although the encyclopedia covers many things of little value to chemical engineers, there are sections that are of real interest. Some of these are the long series of articles on individual types of plastic materials, and the articles on fillers, coloring, luminescent pigments, plasticizers, solvents, chemicals, and ion exchange resins.

In the section on materials, each article follows a similar pattern, which makes for easy reading. In order, the facets of the plastic discussed are: recent developments, history, chemistry, general characteristics, applications, forms available, typical applications, references, and trade names. Covering such items as these, each article is a complete, brief review of the present status of the particular resin.

The sections on new applications, engineering (mold) design, fabrication, and stock molds will be of little interest to the chemical engineer as a whole. On the other hand, specialized groups of engineers will find use for the sections on coating, film and sheeting, synthetic fibers and fabrics, and laminates and resin-wood products.

Generally, the format of the encyclopedia follows previous years. The publishers have, however, returned to binding the encyclopedia into a single volume, except for the charts. They say that this was done by popular request. The reviewer is sorry, but he cannot agree. As it is, the book is just too hard to handle. On the other hand, perhaps the best things about the book are the liberal tables and indices. These will probably be the most valuable day-to-day sections.

RECENT BOOKS RECEIVED

Calculations of Quantitative Analysis. By P. W. West. Macmillan. $2.75.

Inorganic Process Industries. By K. A. Kobe. Macmillan. $6.

An Introduction to Color. By R. M. Evans. Wiley. $6.

Principles of Servomechanisms. By G. S. Brown & D. P. Campbell. Wiley. $5.

Progress in the Theory of the Physical Properties of Glass. By J. M. Stevels. Elsevier. $2.

Some Aspects of the Luminescence of Solids. By F. A. Kroeger. Elsevier. $5.50.

Trends in Engineering Education. By J. K. Finch. Columbia. $2.

Underwater Explosions. By R. H. Cole. Princeton. $7.50.

Municipal Water

WATER PURIFICATION CONTROL. *By Edward S. Hopkins. The Williams & Wilkins Co., Baltimore, Md. 289 pages. 1948. $4.*

Reviewed by Sheppard T. Powell

FIRST edition of this book appeared in 1932 and was revised in 1936, but there was no further revision until 1948. From the earliest edition the book has fulfilled a definite need as an informative and reliable text on water conditioning as related to the treatment of water for sanitary uses. The author has adhered to the original type of presentation, which clearly sets forth the major problems of the treatment of water for municipal requirements and the present state of the art. The arrangement of the subject matter is particularly well organized and coordinated and the selective bibliography has been well chosen and should prove especially informative to students and operators of water treatment systems. The illustrations are well arranged and are helpful as an adjunct to the excellent description given in the text. Two chapters, viz., "Color Removal" and "Removal of Iron and Manganese," have been included in the last edition which were not presented as complete chapters in the earlier editions.

The book is an authoritative manual on water treatment appliances and their operation, and much practical advice has been presented which will be found helpful to all interested in the art of water treatment.

Wartime Research

Q.E.D.-M.I.T. IN WORLD WAR II. *By John Burchard. John Wiley & Sons, New York. 354 pages. $3.50.*

Reviewed by H. C. Parmelee

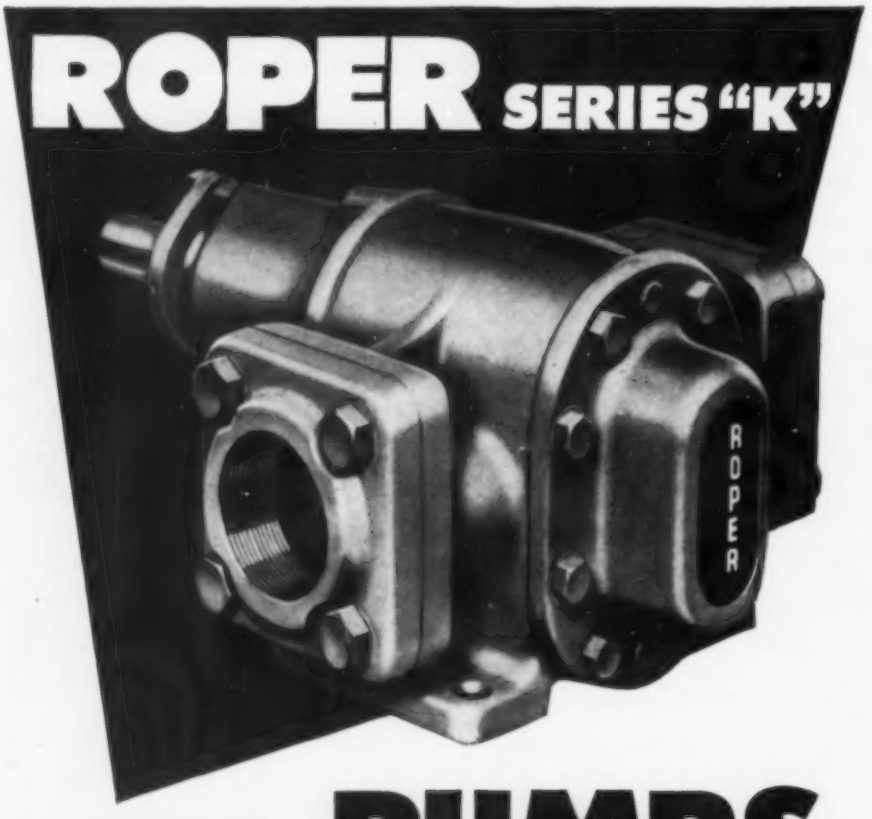
TYPICAL of the aid given to the armed forces of the Allies by academic institutions, this record of the war service of the Massachusetts Institute of Technology is nevertheless a conspicuous example of such assistance. The story is told with becoming modesty, but it reveals the extraordinary facilities and personnel that M.I.T. was able to apply to the scientific solution of many problems confronting professional military and naval leaders. As President Compton says in the foreword to Q.E.D., "No one can read the story . . . without being impressed by the fact that the Massachusetts Institute of Technology is a tremendous national asset."

Although its greatest contribution to national welfare and security was undoubtedly the technical training of about 33,500 alumni as of January 1942, it was almost inevitable that out of this large number some M.I.T. alumni, and staff, should be found in places of high responsibility in national agencies for research and development. The roster includes Bush, director of the Office of Scientific Research and Development; Compton, Jewett, and Tolman, members

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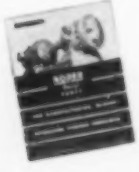


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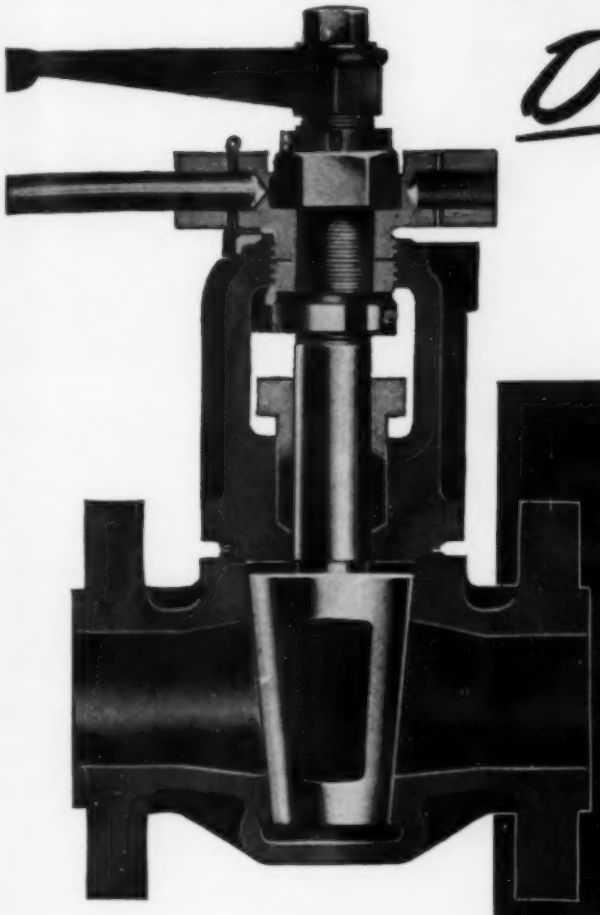
of the National Defense Research Committee, with Moreland as executive officer; Jewett and Hunsaker at the head of the National Academy of Sciences; Hunsaker as chairman of the National Advisory Committee for Aeronautics, and as coordinator of research in the office of the Secretary of the Navy; and Bowles as expert consultant to the Secretary of War.

The wartime policy of M.I.T. was naturally to undertake only those research projects which it was best equipped to tackle. Outstanding was its work on radar and fire-control of guns, with significant contributions to the solution of problems in submarine warfare, rockets, bombs, guided missiles, incendiaries, optics, and metallurgy. But in addition to this heavy program of "homework," members of M.I.T.'s staff also worked directly for the Army, the Navy, and the Office of Field Service of OSRD.

A peacetime development at M.I.T. —the Division of Industrial Cooperation organized in 1920—proved to be an unconscious preparation for meeting the war crisis. Through the D.I.C. the Institute's facilities and personnel had been available for industrial research under contract with a specific industry or company. It was necessary only to expand this mechanism to take on contracts for research in the national defense, which ultimately amounted to about $125 million. More than three-fourths of this amount was appropriated to the Radiation Laboratory which did fundamental research on microwaves. It participated in the development of 150 different radar systems applicable to numerous problems, and was almost solely responsible for LORAN, a long-range navigational method. Another important development was the ground-control-approach systems for landing aircraft in fog or darkness. Equally useful were the fire-control mechanisms developed in the Confidential Instruments and Servomechanisms Laboratories, the former producing improved gun sights and the latter remote control for heavy guns that could not be hand-directed. Still other projects yielded impressive results, but it is impossible even to catalog them within the limits of this review.

Meantime, with so much talent and energy directed to special research, the Institute had to continue its primary function of teaching. Its program had to be drastically modified by the demands of the Army and the Navy for specialized training courses, and it was complicated by the confused and unsettled policies of the Selective Service administration. But the challenge was met; and although M.I.T. was strained academically close to the

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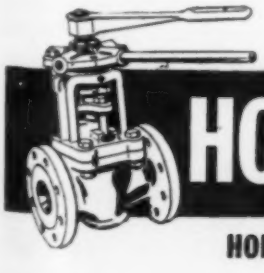
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danger line, it survived the ordeal. Then followed the inevitable demobilization and reconversion after the war ended. New programs were adopted, new facilities were blueprinted, and new financing was undertaken. Students had to be accommodated in larger numbers than ever before. But, judged by any standard, the Institute gained strength as a result of its war activities. Almost 100 percent of its senior professors on leave returned, and high standards of selection were made in new appointments from among the large number of outstanding men with whom the staff and administrative officers came in contact during the war. The redeployed M.I.T. remains "a tremendous national asset."

Statistical Quality Control

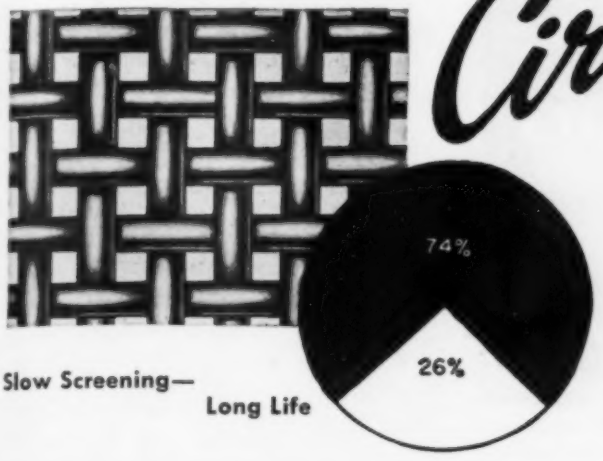
CONTROL CHARTS. *By Edward S. Smith. McGraw-Hill Book Co., New York. 161 pages. $3.*

Reviewed by J. K. Borland and L. C. Miller

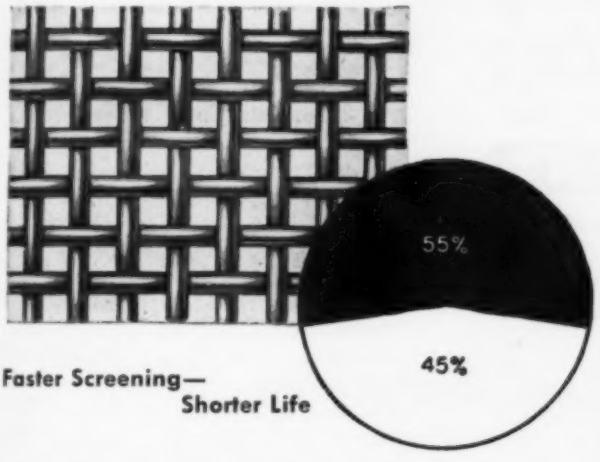
As a recent addition to the McGraw-Hill Industrial Organization and Management Series this book is intended to introduce the use of control charts to those "who wish to acquire knowledge of the methods and charts of statistical quality control, but are too busy to have an interest in the mathematical aspects of the methods." The author succeeds in building a strong case for using control charts and explains them clearly. Charts and diagrams are used liberally so that the actual text takes up only a little over 100 pages; only the simplest kind of algebra has been used. Hence, an evening or two at most should suffice to inform the reader on how to make and read the control charts used in applying statistical quality control. Possibly greater emphasis should have been put on interpreting the charts and it is unfortunate that nearly all of the author's examples concern manufacturing small mechanical parts. Chemical engineers may find it hard to visualize the counterpart applications in chemical processes.

The author properly avoids discussing systematic errors (of gaging, etc.) as being beyond the province of control charting. He succeeds in presenting frequency distributions in nonmathematical terms and explains quite simply the construction of control charts for averages, ranges, fraction defective, number of defectives, and number of defects. Of special interest is a table the author has worked out to reduce the labor of finding the control limits for fraction defective; it should save time in many cases. In the last chapter Professor Smith bows

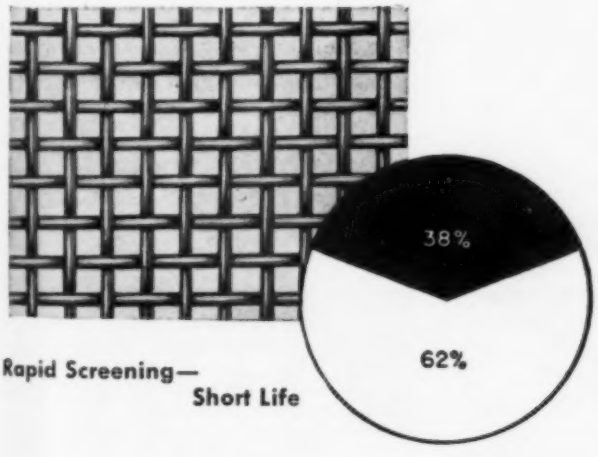
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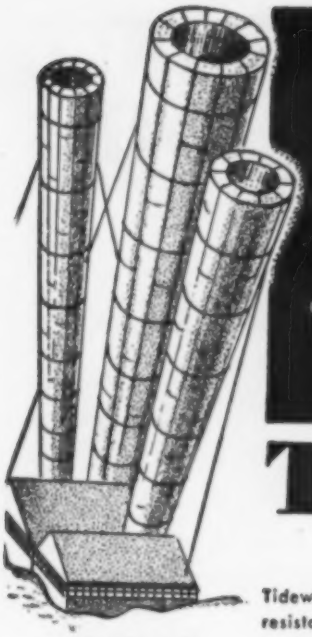
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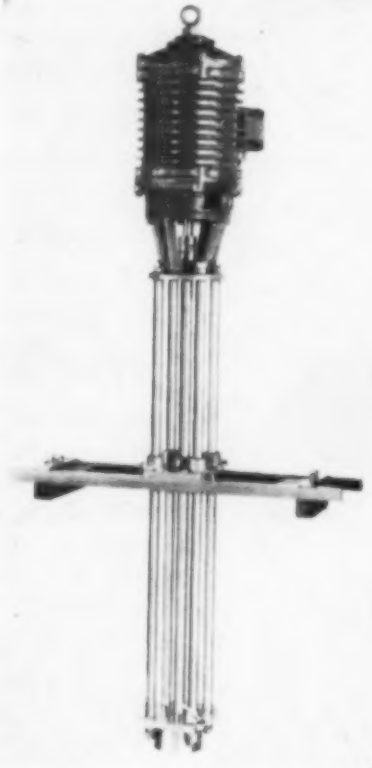
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to convention and shows how his simplified formulas are related to the standard deviation and the formal expressions of control chart limits. This should prepare those interested for reading more extensively on the subject in the short bibliography given at the end of the book.

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Fats and Oils

THE CHEMICAL CONSTITUTION OF NATURAL FATS. *Second edition. By T. P. Hilditch. John Wiley & Sons, New York, 545 pages. $9.*

Reviewed by Gordon W. MacBride

MANY notable advances since the first edition of this book was published in 1940 have been reviewed by the author. Most of the important contributions published up to 1946 have been mentioned with the result that the book has been expanded by about 100 pages.

Addition of numerous data throughout the book will be welcomed by research and development engineers. Revision and expansion of the chapter on experimental technique employed in the quantitative investigation of fats is noted, especially in regard to the methods of interpretation of ester-fractions involved in the determination of component acids.

Arrangement of the indexes has been made more clear, the author hopes. Comments on the first edition (reviewed in *Chem. & Met.*, November 1940, page 807) apparently have justified continuing the treatment of subject matter by means of several indexes.

The book is well printed and well bound. Its value as a reference volume should win it many friends.

RECENT BOOKS and PAMPHLETS

Handling and Storage of Metal Drums (Single-Trip) for Liquids. Manual Sheet D-33, published by the Manufacturing Chemists' Association, 608 Woodward Bldg., Washington 5, D. C. 12 pages. 20 cents. Revised recommendations covering all phases of handling single trip, tight head metal drums for liquids.

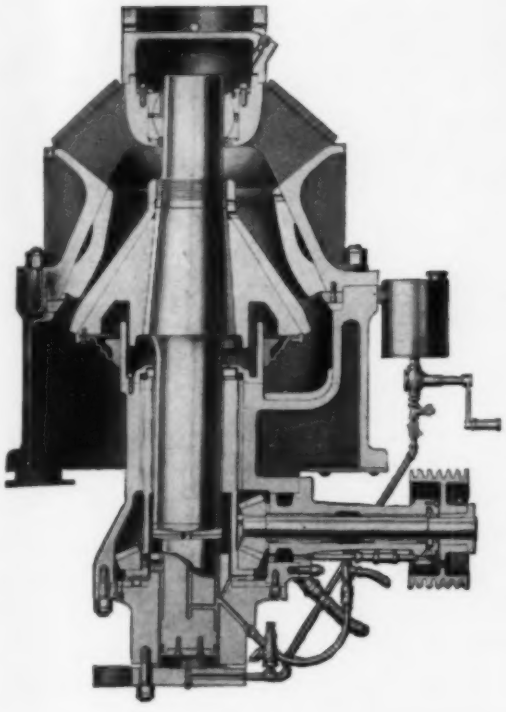
Price List of American Standards. Published by the American Standards Association, 70 East 45th St., New York 17, N. Y. 24 pages. Gratis. A listing of all national standards approved by the American Standards Association.

Trends in State Labor Laws. Published by Department of Manufacture, Chamber of Commerce of the United States, Washington 6, D. C. 46 pages. A compilation of surveys of recent state labor legislation.

A.S.T.M. Standards on Rubber Products (With Related Information). Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 580 pages. $4. February, 1948, annual issue giving specifications and methods of testing.

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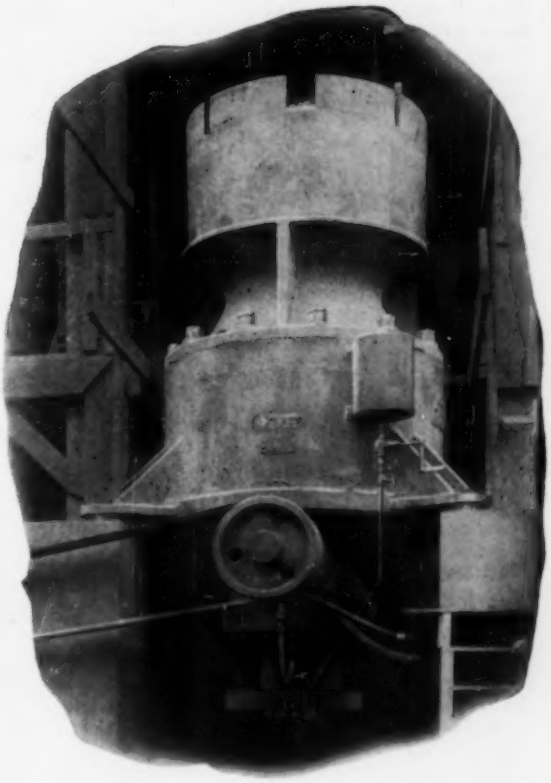




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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons or check. Do not send postage stamps. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

Facilities for Pulp and Paper Research at the U. S. Forest Products Laboratory. By G. H. Chidester. No. R1499. Available only from Forest Products Laboratory, Madison 5, Wis. Processed.

Performance of a Diesel Mine Locomotive. By L. B. Berger and R. T. Fritz. Bureau of Mines, Report of Investigations R. I. 4287. Mimeographed. Primarily applicable to some diesels for underground use, but significant also for this type of equipment generally.

Survey of Commercial Aviation-Gasoline Characteristics, March 1947 Production. By W. C. Holliman, et al. Bureau of Mines, Report of Investigations R. I. 4273. Mimeographed.

Dielectric Constant in Air-Ambient Electrostatic Separation. By Foster Fraas and Oliver C. Ralston. Bureau of Mines, Report of Investigations R. I. 4278. Mimeographed. A mathematical analysis.

Trends in the Consumption of Fibers in the United States 1892-1946. By Robert B. Evans and Barclay Meadows. Bureau of Agricultural and Industrial Chemistry, ACE-93, revised. Mimeographed. Available only from Southern Regional Research Laboratory, New Orleans 19, La. An elaborate statistical summary of over fifty years of fiber development, with interpretation of the technical and economic factors and trends.

Imparting Water Repellency to Textiles by Chemical Methods: An Index of Compounds Used. By H. A. Schuyten, et al. Bureau of Agricultural and Industrial Chemistry, AIC-179. Mimeographed. Available only from Southern Regional Research Laboratory, New Orleans 19 La.

United States Import Duties (1948). U. S. Tariff Commission. Price $2. A restatement in tabular form of all the duty provisions of the Tariff Act of 1930 with the original language and rates appropriately modified to show the current duties where they differ from those in the Tariff Act of 1930.

Military Procurement. The Munitions Board. Price 25 cents. A guide for joint industry-military procurement planning.

Construction Volume and Costs, 1915-1947. Supplement to Construction and Construction Materials Industry Report, Bureau of Foreign and Domestic Commerce. Processed. A statistical summary of unit costs and index numbers of various factors involved in industrial construction and construction materials over a period of the past 32 years.

Copper Naphthenate Wood-Preservative. National Bureau of Standards, TS-4578. Recommended commercial standard for spray, brush, and dip application.

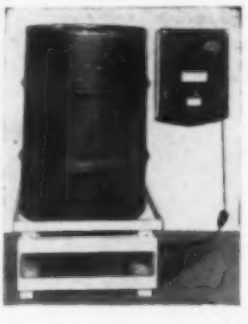
Tetraethyl Pyrophosphate and Methods for Its Analysis (Report of Industry-Government Cooperative Studies). Bureau of Entomology and Plant Quarantine. Processed. A report of a cooperative study between industry and government developing particularly analytical control information.

New Dry Concentrating Equipment. By W. J. Long. Bureau of Mines, Report of Investigations R. I. 4286. Mimeo-

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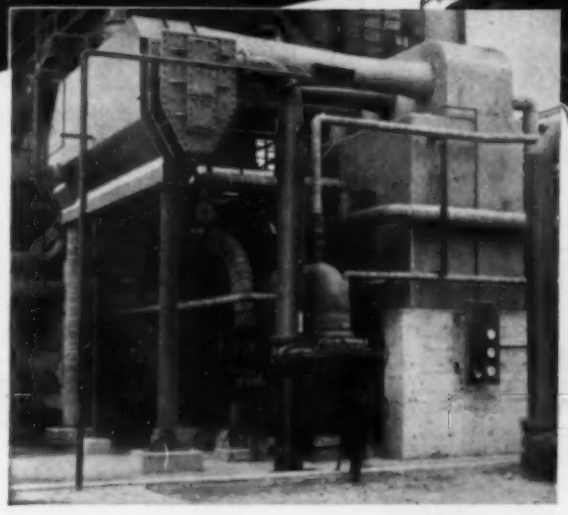
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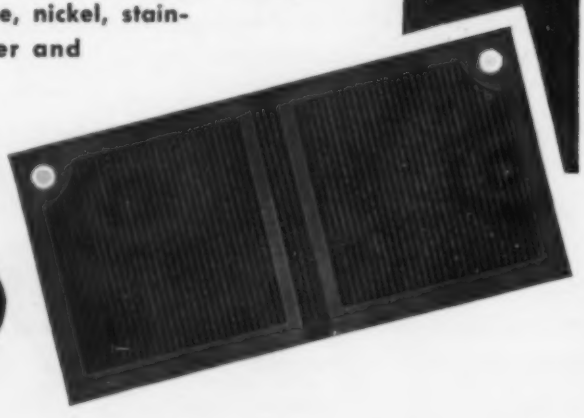
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graphed. A description of available vibrating, air separator, magnetic, and other types of equipment applicable to chemical process industry as well as to minerals.

Analyses of Crude Oils from 283 Important Oil Fields in the United States. By C. M. McKinney and O. C. Blade. Bureau of Mines, Report of Investigations R. I. 4289. Mimeographed. A tabular resume of chemical composition and physical properties of oils tested by the Bureau recently.

Effect of Size and Shape of Specimen on the Tensile Strength of Fiberboards. By W. C. Lewis. No. R1716. Available only from Forest Products Laboratory, Madison 5, Wis. Processed.

Remedial Measures for Building Condensation Difficulties. By L. V. Teesdale. No. R1710. Available only from Forest Products Laboratory, Madison 5, Wis. Processed. A discussion primarily applicable to house construction, but significant on principles involved in industrial structures where wall condensation is encountered.

List of Publications on the Growth, Structure, and Identification of Wood. No. R177. Available only from Forest Products Laboratory, Madison 5, Wis. Processed.

Trade Association Industrial Research. By Gustav E. Larson. U. S. Department of Commerce, Industrial Series No. 77. Price 25 cents. Describes and discusses typical trade association activities in research fields.

Trade Association Opportunities in Marketing Research. By Theodore K. Pasma. U. S. Department of Commerce, Industrial Series No. 78. Price 25 cents. Attempts to provide a practical guide for trade associations.

Power Market Survey, Colorado River, Upper Basin, Part I—Power Requirements. Federal Power Commission. FPC-P-15. Price $1. Order only from Federal Power Commission, Washington 25, D. C. First in a series which will eventually cover the entire Colorado River Basin.

Chemical Treatment and Seasoning of Thick Beech Stock. By Edward C. Peck, et al. Forest Products Laboratory, Madison 5, Wisconsin. R1708. Processed. Reports comparative results on untreated and treated wood.

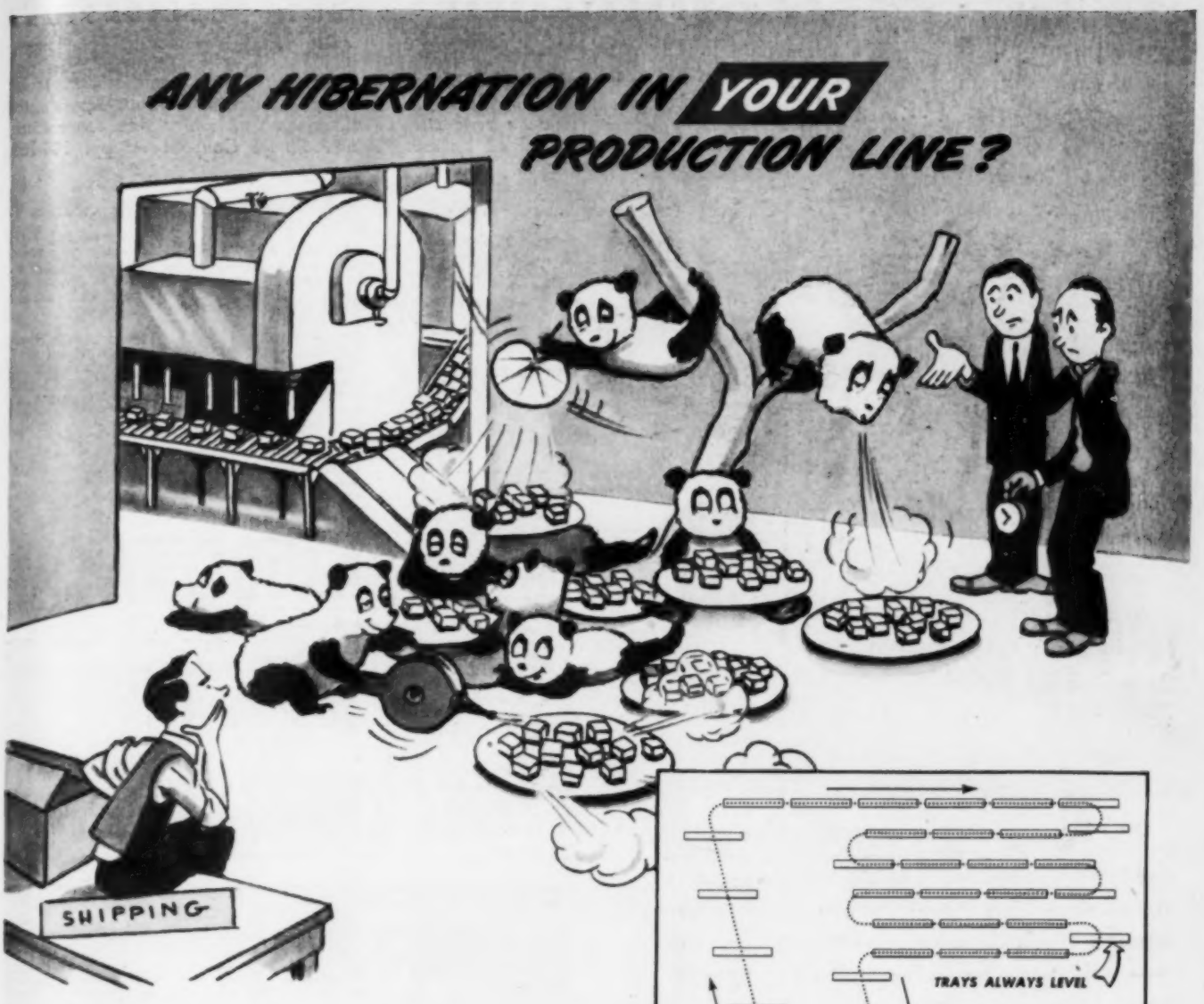
Treating Wood in Pentachlorophenol Solutions by the Cold-Soaking Method. By J. Oscar Blew. Forest Products Laboratory, Madison 5, Wis. R1445. Processed.

Bleaching Wood. By Leslie E. Downs. Forest Products Laboratory, Madison 5, Wis. R1705. Processed.

Behavior of House Paints on Different Woods. By F. L. Browne. Forest Products Laboratory, Madison 5, Wis. R1053. Processed. Describes long-term exposure tests with results.

Electrolytic Preparation of Zinc Dust. By Walter Eckhardt, translated by O. C. Ralston. Bureau of Mines, Information Circular I. C. 7466. Report made available through Field Information Agency, Technical (FIAT) of the Office of Military Government for Germany (US). Mimeographed.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog have been issued on the following items: Diamyl-Phthalate; Plasticizer (for use in organic coatings) TT-D-291. Dibutyl-Phthalate; Plasticizer (for use in organic coatings) TT-D-301. Dipentene (for use in organic coatings) TT-D-276. Enamel (for) Drums and other Metal Products, Rust-Inhibiting, Olive Drab TT-E-485-b. Enamel; Interior, Gloss, Tints and White TT-E-506b. Fertilizers, Mixed, Commercial O-F-241. Grease; Lubricating, Automotive and Industrial VV-G-632. Hydroquinone (1,4-Dihydroxy-benzene), Photographic O-H-886a. Ink; Marking, Quick-Drying, for Photographic Film TT-I-545. Lubricants; Enclosed-Gear, Hypoid-Gear, and other Types VV-L-761. Potassium Chloride (Muriate of Potash); for Fertilizer Purposes O-P-553. Sodium Nitrate (Nitrate of Soda); for Fertilizer Purposes O-S-634. Superphosphate; for Fertilizer Purposes O-S-816. Price 5 cents each.



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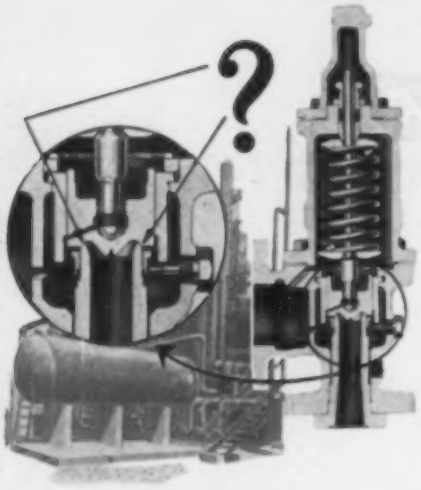
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Chemical Engineering's Readers' Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 159-160.

(Continued from page 160)

114. Perlite Insulation. General Perlite Co., San Jose, Calif.—A 6-page folder that gives facts and figures on the advantages of granular perlite for insulation purposes. Gives bulk density, K factors, thermal conductance, coverage, resistance to flame and other data on this new material.

115. Electric Motors. U. S. Electrical Motors, Inc., Los Angeles, Calif.—16-page bulletin illustrating and describing the latest models of syncrogear motors made by this company.

116. Alloys. Haynes Stellite Co., Kokomo, Ind.—87-page book featuring this company's alloys for high temperature service. Contains all available data on these alloys that have been filed by the National Defense Research Council, the National Advisory Committee for Aeronautics, and other manufacturing concerns.

117. Stainless Steel. Allegheny Ludlum Steel Corp., Pittsburgh, Pa.—32-page booklet giving information on solid and clad stainless plates and their fabrication.

118. Industrial Lighting. American Structural Products Co., Toledo, Ohio—36-page booklet outlining the use of glass block in the construction of industrial buildings.

119. Carbon Black. Witco Chemical Co., New York, N. Y.—10-page pocket size folder which, when unfolded, is a chart giving properties of the different types of carbon blacks made by this company, as well as those made by other companies.

120. Belting. Buckner Process Co., Worcester, Mass.—6-page circular describing and illustrating the conveyor belting, transmission belting, and safety matting made by this company.

101. Pumps. Nagle Pumps, Chicago, Ill.—Bulletin No. 4711, 36-page bulletin illustrates and describes this company's line of horizontal and vertical shaft centrifugal pumps. Details of construction are shown and sizes, dimensions and weights are tabulated.

122. Alloys. Chicago Steel Foundry Co., Chicago, Ill.—10-page booklet illustrating and describing various types of equipment made from this company's alloys.

123. Valves. Lunkenheimer Co., Cincinnati, Ohio.—12-page pocket size booklet No. 534 features a new line of "Union Bonnet" bronze gate valves made by this company.

121. Heat Exchangers. Young Radiator Co., Racine, Wis.—Catalog No. 448 contains 8 pages featuring the cooling and condensing units made by this company.

125. Protective Coatings. Morton Chemical Co., Greensboro, N. C.—6-page folder describing Duramite pH coating resistant to acids, alkalies and other corrosive substances. Contains application data and a partial list of products to which this material is resistant.

126. Waste Disposal. Productive Equipment Corp., Chicago, Ill.—Bulletin No.



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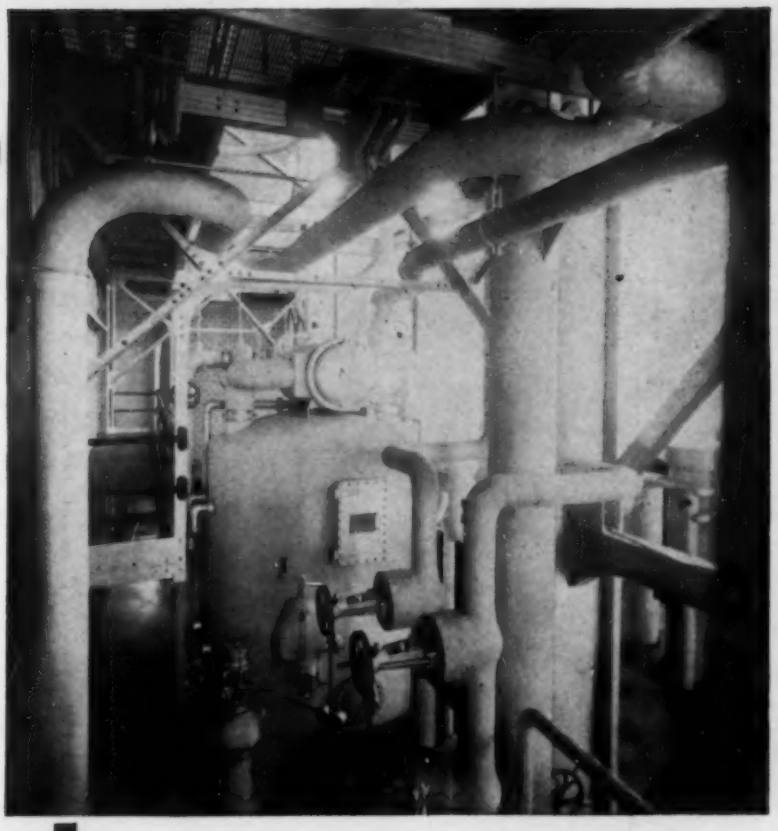
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448. 4-page leaflet illustrating and describing the Selectro vibrating screen for use in dewatering industrial waste.

127. Ion Exchange. Barnstead Still & Sterilizer Co., Boston, Mass.—Bulletin 117 is a 2-page leaflet describing and illustrating the Type R Upflo demineralizer made by this company.

128. Management Engineering. The Emerson Engineers, New York, N. Y.—22-page brochure entitled "Your Production Problems". Services available from this company are outlined.

129. Tank Lining Compound. Union Bay State Chemical Co., Cambridge, Mass.—8-page booklet describing this company's tank lining compound for corrosion proofing. Details of application are given and tables of materials to which the compound is resistant are listed.

130. Lime Slaker. The Dorr Co., New York, N. Y.—Bulletin No. 7281. 4-page booklet illustrating and describing the continuous lime slaker made by this company. Its use and operation are described.

131. Packing. Crane Packing Co., Chicago, Ill.—8-page booklet featuring the hydraulic sealing ring made by this company. Contains specifications, dimensional standards in tabular form, together with other information.

132. Ion Exchange. National Aluminate Corp., Chicago, Ill.—Booklet describes principles, properties and uses of ion exchangers. Contains technical data on the ion exchange materials available from this company.

133. Hoists. Lisbon Hoist & Crane Co., Lisbon, Ohio—8-page booklet featuring the "Bob Cat" electric hoists made by this company. Details of construction are illustrated.

134. Paper Coating. The Dow Chemical Co., Midland, Mich.—15-page bulletin entitled "Ethocel Hotmelts for Paper Coatings." Describes this material, how it is employed, and the properties obtained when used on papers.

135. Alarm Systems. The Autocall Co., Shelby, Ohio—8-page booklet covering the Autocall line of fire alarm equipment. Includes wiring diagrams for various systems.

136. Chromium Plating. Chromium Corp. of America, New York, N. Y.—36-page illustrated booklet outlines the uses of chromium plating and describes the plating service available from this corporation.

137. Vacuum Equipment. The Spencer Turbine Co., Hartford, Conn.—Bulletin No. 144. 20-page booklet illustrating and describing briefly 132 uses for vacuum in different types of industries.

138. Surface Active Agents. M. Michel & Co. Inc., New York, N. Y.—Booklet describing Michelene Surface Active Agents for use in various industries.

139. Condensers. Schutte & Koerting Co., Philadelphia, Pa.—8-page bulletin No. 5-B, illustrates and describes this company's low-level eductor condensers which operate on the jet principle. Typical installations are illustrated.

140. Ventilators. Powermatic Ventilator Co., Cleveland, Ohio—30-page catalog illustrating the application of the iron lung power ventilator for use on industrial buildings.

141. Roof Coolers. Sigfried Ruppright, Los Angeles, Calif.—6-page folder featuring the roof cooling equipment made by this company.

142. Power Equipment. Schutte & Koerting Co., Philadelphia, Pa.—Diagrammatic layout of a high-pressure power plant which illustrates the application of this company's power plant equipment.

143. Stainless Steel. Allegheny-Ludlum Steel Corp., Pittsburgh, Pa.—36-page booklet outlining the uses of this company's alloys in chemical process industries.

124. Blowers. Industrial Division, Bryant Heater Co., Cleveland, Ohio—Bulletin 6A-4 describes the complete line of light-weight, centrifugal blowers

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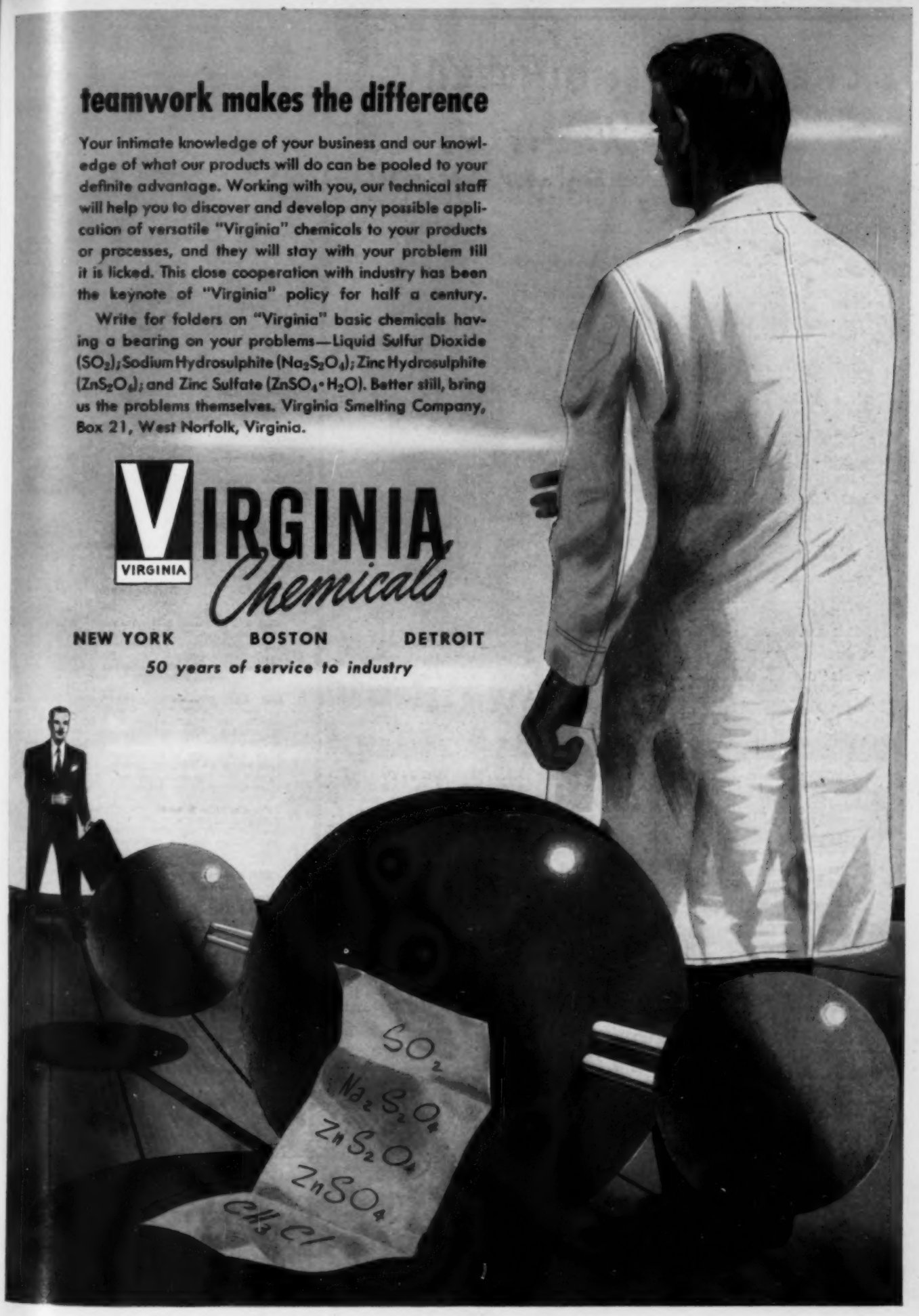
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152. Lift Truck Attachment. Hyster Co., Portland 8. 6-page folder gives information on hydraulically operated load grab attachment for lift trucks which picks up bales, boxes and barrels without the use of pallets.

153. Lift Trucks. Hyster Co., Portland 8. Four illustrated 16-page bulletins describe the Hyster 2,000, 4,000, 7,500 and 15,000-lb. lift trucks, their features, specifications and uses. 4-page bulletin also describes briefly the four above lift trucks, a 10,000-lb. mobile crane truck, a 12,000-lb. mobile hoist truck and a 30,000-lb. mobile hoist truck.

114. Carbon Black. A. C. Horn Co., Inc., Long Island City, N. Y.—2, 4-page leaflets featuring this company's carbon black for use in darkening air entrained concrete.

126. Valves. Black, Sivalls and Bryson, Inc., Kansas City, Mo.—4-page booklet illustrating and describing valves for salt water disposal service.

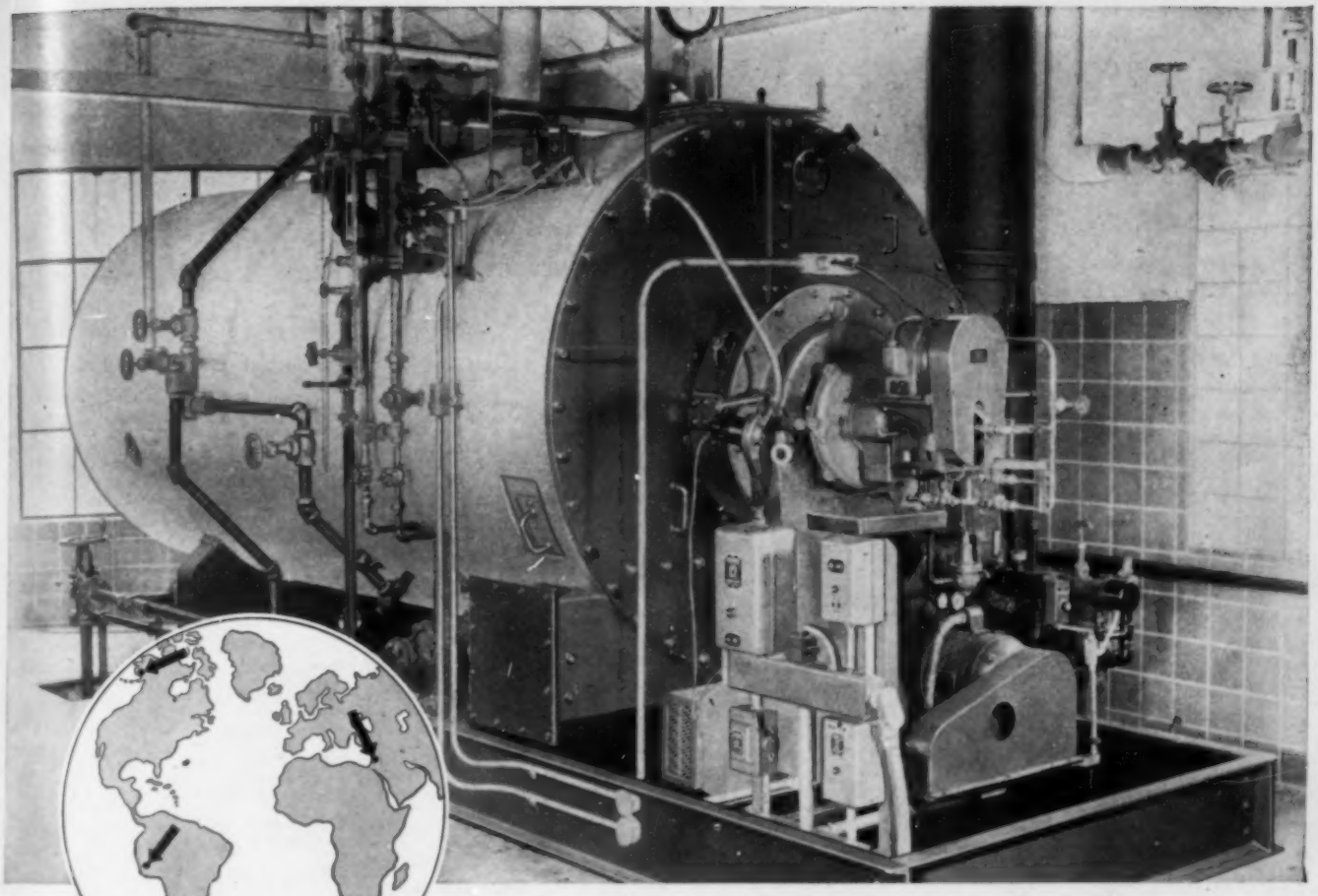
156. Electrical Generators. Columbia Electric Mfg. Co., Cleveland, Ohio—Four page booklet describing the high speed, revolving field type synchronous A.C. generators.

157. Welding. Tube Turns, Inc., Louisville, Ky.—Four page illustrated booklet describing the groove type welding rings with knock-off spacer pins for use in the fabrication of welded pipe systems. Details of application are illustrated.

158. Separation Processes. American Cyanamid Co., New York, N. Y.—40-page bulletin contains test data and illustrations of the Dutch State Mines cyclone separator processes together with hitherto unpublished data on the heavy-media separation processes. Illustrations and flowsheets are shown.

159. Metal Tower Packing. Scientific Development Co., State College, Pa.—Two page leaflet No. B7 illustrating and describing metal packing for distillation and absorption columns.

170. Heaters. Young Radiator Co., Racine, Wis.—16-page catalog illustrates and describes this company's line of circular Vertiflow unit heaters for high ceiling installations. Principles of operation are illustrated and tables of engineering data are included.



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CHEMICAL ECONOMICS

Richard F. Warren, ASSISTANT EDITOR

Third Quarter Chemical Consumption Remains at High Levels

CONSUMPTION of chemicals in the third quarter continued to meet expectations. However, some slack was caused by labor difficulties and the seasonal slump in some consuming industries. While complete data are not available, preliminary figures indicate that the third quarter will be substantially above corresponding 1947 levels.

Among the major industries that consume chemicals, the soap and detergent, petroleum, pulp and paper, iron and steel, rayon, and fertilizer industries are operating well above last years rates. Even industries like textiles, leather and glass container industries which have fallen off in recent months remain well above prewar peaks.

Plate Glass Increase

Offsetting the drop in the glass container industry, the plate glass output in June set a new production record of 24,207,601 sq. ft. For the first half of this year another record output of almost 136 million sq. ft. was achieved.

Chemical Engineering's index of industrial chemical consumption bears out this trend. It rose in May to 239.82. This was surpassed only by the peak it reached in March. Fertilizers, pulp and paper, industrial explosives, paint and varnish, rayon as well as coal products moved up over April. Among components of the index that reached a new high for the year were pulp and paper, petroleum refining, paint and varnish, and industrial explosives. Comparison of the first five months average index (233.25) with the average for the first quarter (231.28) shows that the optimism expressed by many industry spokesmen early in the year was justified. It also shows the ability of the industry to grow despite the pitfalls in its path.

Plastics raw material manufacturers are not discouraged by the recent slowing up in the industry. Union Carbide and Carbon Corp. is increasing its productive capacities at Bound Brook by 50 percent and is building a 25 million pound per year polystyrene unit there. Dow is expanding its vinyl production units and Monsanto is building several new plastics units. Du Pont has almost completed its new nylon plastics plant at Washington, W. Va.—this plant will also produce methyl methacrylate plastics and polyethylene. The entire plant will be in operation this fall. Other producers with expansion plans in the works include American Cyanamid, Goodrich Chemical, Durez, and Hercules.

Chemical Engineering Index

Industrial Consumption of Chemicals

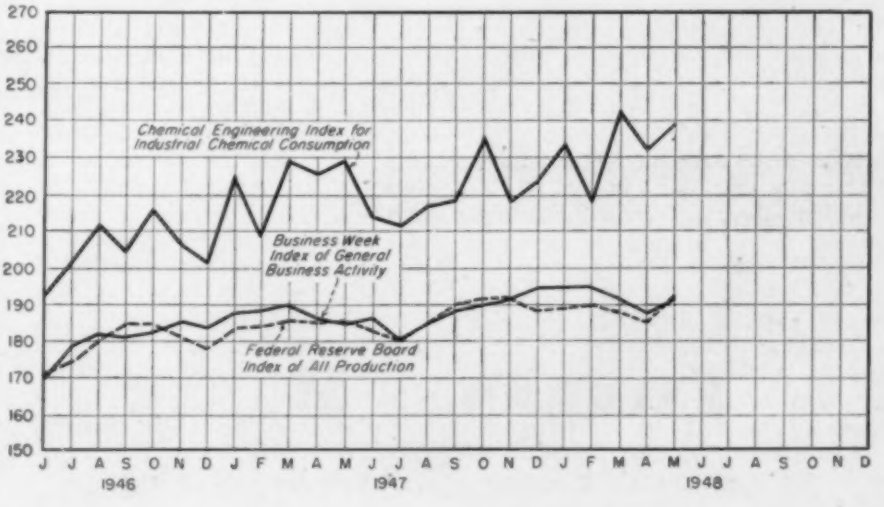
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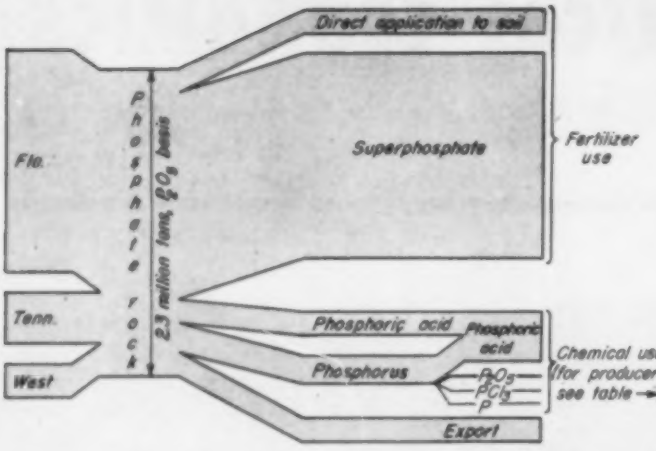
	April (Revised)	May
Fertilizers	58.60	58.96
Pulp and Paper	23.70	24.90
Petroleum refining	21.03	22.08
Glass	20.30	18.59
Paint and varnish	26.82	27.20
Iron and Steel	11.52	13.89
Rayon	25.85	26.35
Textiles	11.55	11.15
Coal products	8.11	10.58
Leather	4.49	4.29
Explosives	6.97	8.98
Rubber	5.06	5.20
Plastics	8.58	7.65
INDEX	232.58	239.82

Higher costs are bothering most producers. Some are taking action to combat recent rises. Du Pont is now shipping methanol by water from Texas to New Jersey in an effort to reduce freight charges. Many other chemical producers are studying similar moves.

The widespread revision of pricing systems and the movement to fob. prices caused by the recent court decisions has not made its full effect felt yet, but with increased costs of steel and other raw materials, many expansion programs that involved decentralization are being carefully checked over to insure that new units will be able to compete in the sellers market that must eventually return. All chemical expansions will eventually feel the pinch of the recent steel price hike and many eastern as well as southern and western plants will feel the added cost of fob. systems. Water transportation has been already pushed in many areas and recent events will accelerate this trend.

Fertilizer consumption in the recently completed fiscal year was about 9 percent higher than last year and 18 percent above the 1945-46 year.





Producer	Location
Monsanto Chemical Co.	Monsanto, Tenn.* †
	Columbia, Tenn.*
	Anniston, Ala.†
	Trenton, Mich.†
Victor Chemical Works	Mt. Pleasant, Tenn.*
	Tarpon Springs, Fla.*
	Chicago Heights, Ill.†
	West Nashville, Tenn.†
	Morrisville, Pa.†
TVA	Wilson Dam, Ala.*†
Oldbury Electro-Chemical Co.	Niagara Falls, N. Y.* †
American Agricultural Chemical Co.	South Amboy, N. J.*
	Carteret, N. J.†
Virginia-Carolina Chemical Co.	Nichols, Fla.*
(Phosphate Mining Co.)	Charleston, S. C.†
Westvaco Chemical Corp.	Pocatello, Idaho*
	Carteret, N. J.†
A. R. Maas Chemical Co.	South Gate, Cal.†
Allied Chemical & Dye Corp.	Marcus Hook, Pa.†
E. I. du Pont de Nemours & Co.	East Chicago, Ind.†
	Graselli, N. J.†
Blockson Chemical Co.	Joliet, Ill.†

* Elemental phosphorus. † Phosphorus compounds.

Structure of the Industry—Where phosphate comes from, where it goes, in what quantity, by whose hand.

Phosphates



PHOSPHATES have become increasingly important in our domestic economy. Not only the fertilizer shortage but also the advent of new phosphate chemicals have focused attention on the phosphate industry.

Here is an industry that depends on the farmers' income to keep it at high levels, since 90 percent of the raw material, phosphate rock, goes into fertilizers and farmers only buy fertilizers when they have money in their pockets.

Superphosphates (products of a reaction of phosphoric or sulphuric acids with the rock) are a very important part of our fertilizer industry and supply the first of the "Big Three" (phosphorus, potassium and nitrogen) needed to give depleted soil the ability to produce good crops. Production of other phosphates is a small but growing part of the chemical industry. Eleven companies (see table) produce the domestic supply of phosphorous and chemical phosphates in the United States—imports are relatively small.

Here is an odd fact about the phosphate fertilizer situation. In spite of the acute fertilizer shortage, the industry runs at only 50 percent of capacity in an average year and operates at only 75 percent of capacity in a boom year! This is due in part to the seasonal nature of the business and storage problems created in operating a plant continuously to provide for the seasonal sales fluctuation, some localized acid shortages, and a shifting of markets to the midwest.

Expansion of current capacities is under way. Raw material for the phosphate industry is phosphate rock. It contains one or more of the related tricalcium phosphates together with some organic and inorganic matter. Most rock is mined in three areas. They are Florida, Tennessee, and the western states (Idaho, Montana, Utah and Wyoming).

The rock is consumed in the fertilizer industry in the production of normal superphosphate (18 percent P_2O_5) and concentrated superphosphate (45 percent P_2O_5). Pulverized rock is also applied directly to the soil. The chemical industry uses it to make elemental phosphorus, which may be used as a chemical or to produce other chemicals.

Consumption has increased rapidly in recent years. In 1900 consumption was about 1 million long tons, by 1940 it has grown to 3.3 million long tons. In 1946 it was up to 6.3 million and in 1947 it rose to 9 million long tons. The Bureau of Mines estimates that in 1951 consumption will be about 8.3 million long tons, or an average annual increase of 6 percent over 1946.

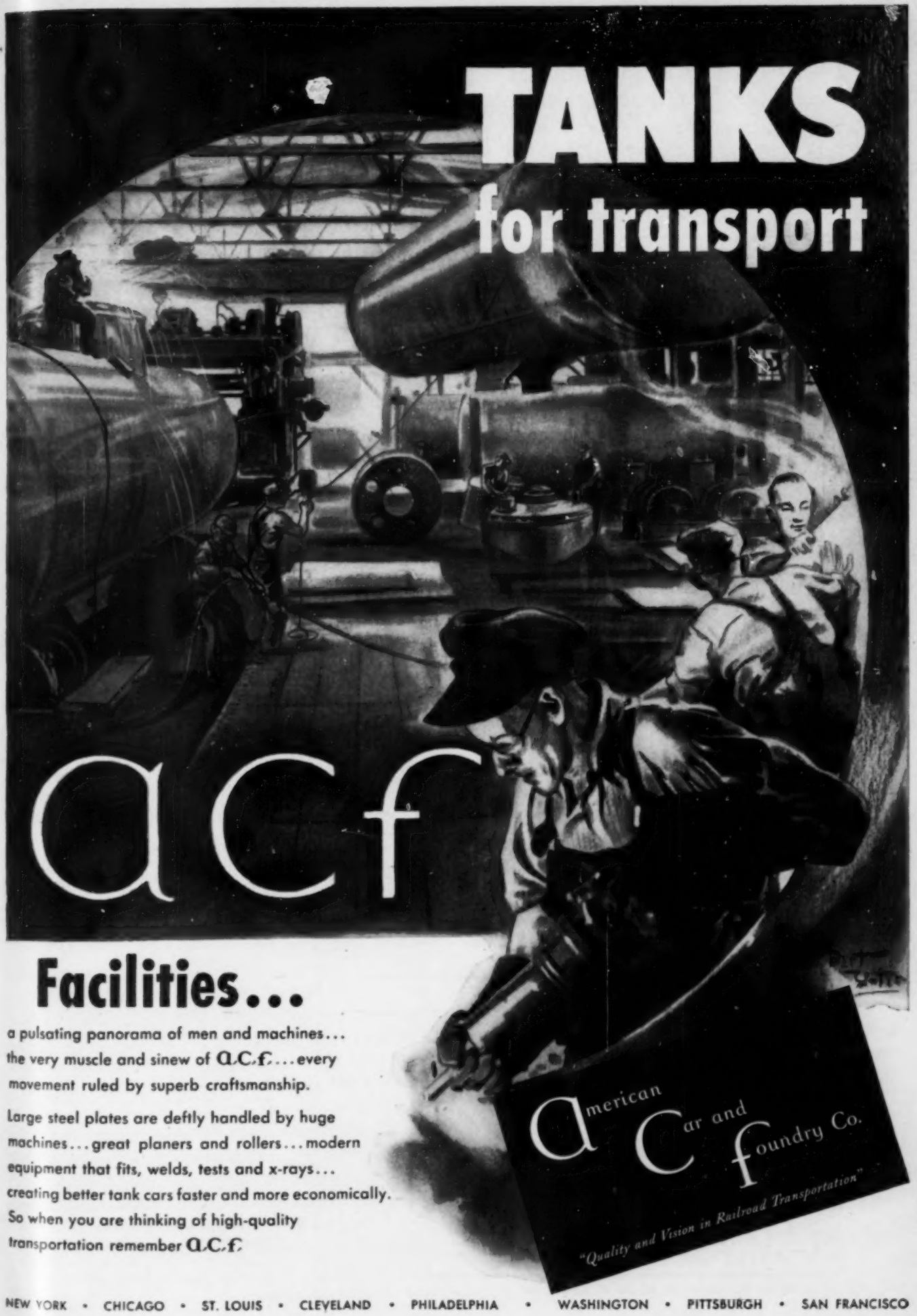
Output of chemical phosphates is growing faster than statistics indicate. This is due to the fact that statistical coverage of complex phosphates is incomplete and there are no comprehensive consumption figures available on chemical phosphates. However, informed industry sources say that the volume of sales is rapidly increasing and in 1947 it is estimated that they reached $50 million. An example of this rapid growth is the combined output of di- and tricalcium phosphates. Production of these salts was 2,700 tons in 1935 compared with 39,000 tons in 1947.

The building block of the chemical phosphates is phosphorus. This is produced from the rock in large quantities by means of blast furnaces and electric furnaces. Phosphorus is used as a metal or it is converted into one of three chemicals that yield a host of products. The three primary chemicals are phosphoric acid (H_3PO_4), phosphorus pentoxide (P_2O_5), and phosphorus trichloride (PCl_3). These chemicals and others produced from them yield compounds that serve the textile dying, cloth processing, ceramics, oil drilling, paint, pharmaceutical, fiber bleaching and processing, leather tanning, plastics, soap, and baking industries.

Production of elemental phosphorus is a difficult and hazardous process. Leading producers spent about six years preparing a commercially satisfactory process. Because it burns in air, special precautions must be taken in production, shipping and handling.

TVA has done a large amount of work on production of elemental phosphorus from electric furnaces. In addition to TVA there are five commercial producers. The others are Monsanto Chemical Co., Victor Chemical Works, American Agricultural Chemical Co., Oldbury Electrochemical Co. and Virginia-Carolina Chemical Co. The last company ceased phosphorus production last year. However, Westvaco Chemical Corp. will begin phosphorus operations next year at Pocatello, Idaho. With this and other current expansions under way, elemental phosphorus capacities will be about 97,000 tons per year by 1949.

However, past performances of these companies indicate that the output will exceed the rated capacities—in contrast to the sub-capacity production in the superphosphate industry. Ability of the chemical phosphate industry to run ahead of its rated capacity is shown by the fact that in 1946 the private producers made 60,200 short tons from a rated capacity of only 41,250 tons.



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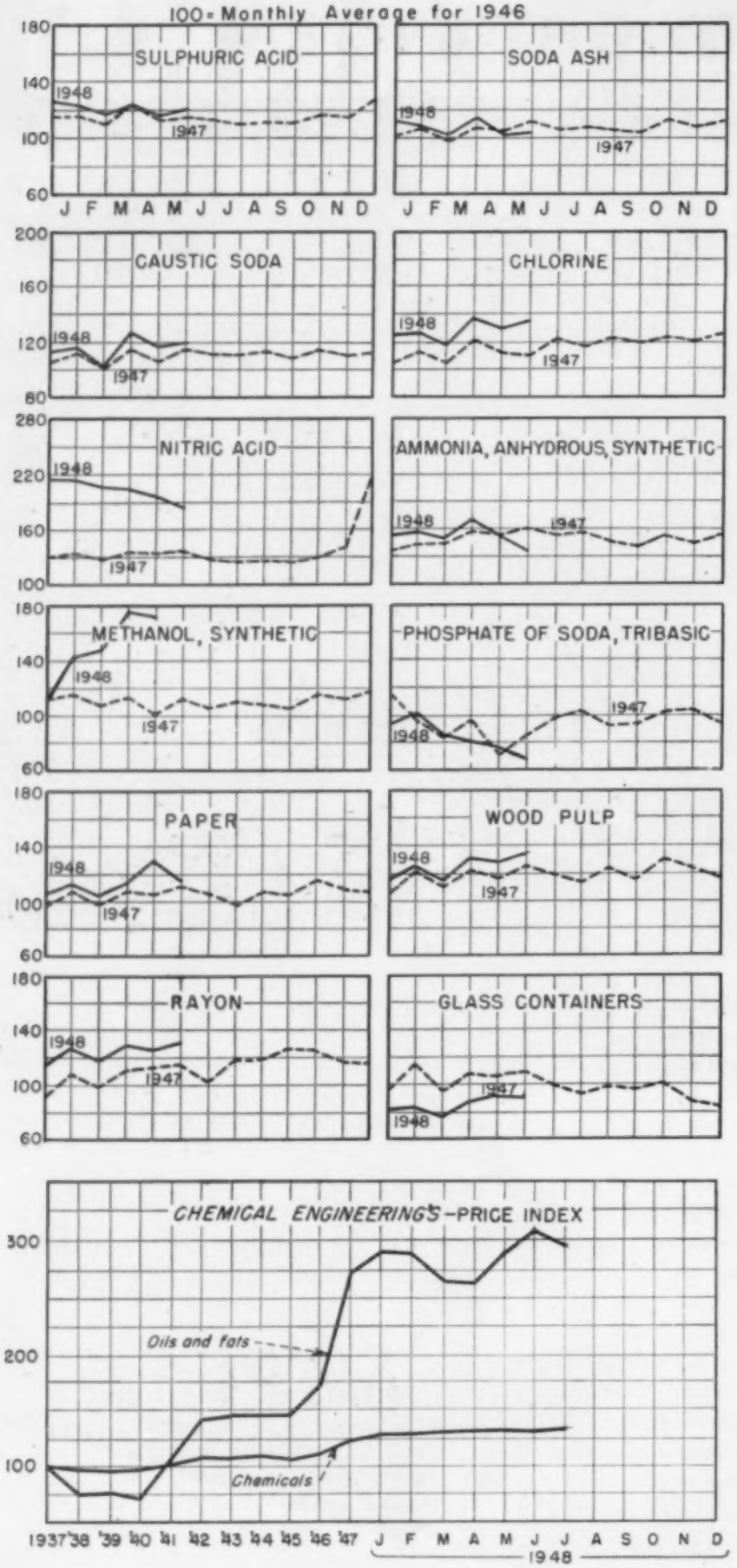
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PRODUCTION, CONSUMPTION AND PRICE TRENDS



HEAVY chemical production continues at high levels. Sulphuric, hydrochloric, and phosphoric acid output rates are considerably above corresponding 1947 and 1946 levels. Record production rates were reached in May by producers of salt cake and monobasic sodium phosphate. Other important chemicals that registered production gains in May include synthetic ammonium sulphate, calcium carbide, carbon dioxide, soda ash, caustic soda and oxygen.

May output of some chemicals fell below the April rate, these included synthetic ammonia, ammonium nitrate, and nitric acid which were set back by labor difficulties. With several strikes in the heavy chemical industry settled, production seemed headed for a high level of activity. However, the strike at Dow's Midland plant which started in July will cut into the output of many organic and inorganic chemicals. The jurisdictional strike at Du Pont's Belle Works has had little adverse effect on production.

Demand for most chemicals continued to exceed production, but with some organic chemicals output fully meeting requirements, a period of competitive selling is in sight for some chemicals.

Petroleum runs to stills rose to record high in June and July, breaking records for three weeks in a row before dropping to 5,633,000 bbl. per day on the week ended July 17.

Price Trends

Chemical prices continued their general upward movement in July. Some inorganics such as white lead and litharge were pushed up in price as both lead and zinc joined steel in moving to higher price levels. Turpentine moved against the trend and dropped 6c. This was due to a drop in "support price" that was reported last month. Monsanto raised the price of tricresylphosphate. Phthalic anhydride also moved up. Oils and fats dropped off in July.

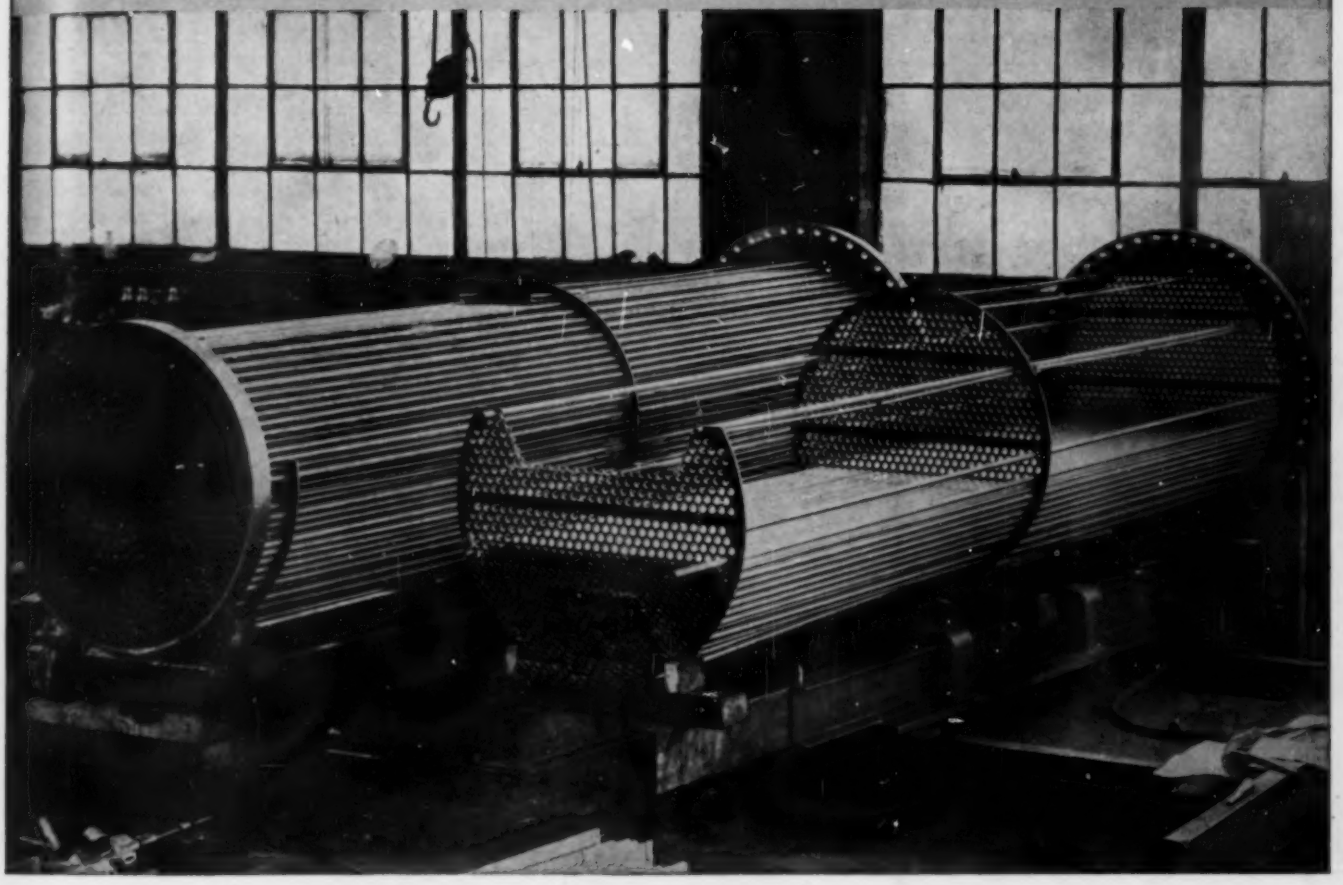
Chemical Engineering

WEIGHTED INDEXES OF PRICES

Base = 100 for 1937

	Chemicals	Oils & Fats
As of August 1	133.04	261.23
Last Month ...	132.59	293.07
August 1947 ..	122.17	222.95
August 1946 ..	111.36	166.39

IT'S IMPORTANT TO KNOW ALL THE FACTORS AFFECTING CONDENSER TUBES



In selecting condenser tubes it is often the case that such conditions as temperatures, pressures, and compositions of the gases and fluids will be taken into account fully, only to have the tubes thus chosen give short service. In such cases, it is wise to call in Revere and ask for a thorough check of the situation before assuming that the wrong alloy was specified.

Here is a case in point. Admiralty tubes in a high stage condenser in a refinery were lasting only three or four months. In the effort to increase life, the sour gas had been treated, but as no improvement was experienced, the treatment was discontinued. The Revere Research report, made after laboratory investigation, stated that Admiralty metal was the correct alloy and its use should be continued, but that microscopic study of a failed tube showed definite and conclusive evidence of fatigue corrosion, probably due to vibration. A conference with the people at the plant revealed that the condenser vibrated considerably. Hence the obvious recommendations: cut down the vibration by better bracing, resume treatment of the gas, and continue to use Admiralty tubes. These recommendations were followed, and when last checked the new Admiralty tubes had been serving for eight months and were still going.

The Revere Technical Advisory Service is eager to serve all users of condenser tubes and plates through close collaboration in the study of difficult problems.

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United States Production of Certain Chemicals

May 1948, May 1947, and Five-Month Totals for 1948 and 1947

Chemicals (Tons unless otherwise noted)	May 1948	May 1947	Total, Five Months 1948	Total, Five Months 1947
Ammonia, synthetic, anhydrous[1]	82,408	97,107	481,145	456,737
Ammonium nitrate	76,000	89,746	435,419	440,938
Ammonium sulphate, technical, synthetic, (M lb.)	29,632	39,076	153,844	156,220
Calcium arsenate (M lb.)	3,483	5,492	15,108	12,341
Calcium carbide, commercial	59,009	56,286	290,234	266,568
Calcium phosphate:				
Monobasic (M lb.)	6,091	3,977	29,283	29,646
Dibasic (M lb.)	6,091	3,944	31,696	29,892
Carbon dioxide:				
Liquid and gas (M lb.)	20,900	22,913	94,614	87,365
Solid (M lb.)	75,317	73,574	271,882	263,313
Chlorine	130,926	123,736	630,048	561,639
Chrome green (C.P.), (M lb.)	1,097	1,311	5,468	6,847
Chrome yellow and orange, (C.P.), (M lb.)	3,871	4,663	21,565	19,184
Hydrochloric acid	38,346	36,966	184,260	177,706
Hydrogen, (million cu. ft.)	2,304	1,656	11,138	8,057
Lead arsenate, acid and basic (M lb.)	3,127	3,694	17,521	22,259
Molybdate chrome orange, (C.P.), (M lb.)	577	344	2,538	2,027
Nitric acid	86,490	101,656	486,815	356,922
Oxygen, (million cu. ft.)	1,370	1,188	6,622	5,663
Phosphoric acid, 50 percent	99,045	82,372	487,584	407,395
Soda ash:				
Ammonia soda process:				
Total wet and dry[2]	360,110	396,282	1,866,305	1,879,105
Finished light[3]	174,459	188,794	655,101	811,399
Finished dense	125,350	147,609	628,530	680,813
Natural[4]	25,439	22,881	121,415	106,259
Sodium bicarbonate	13,387	17,512	58,042	81,624
Sodium biehromate and chromate	7,962	7,474	38,887	34,625
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	126,100	117,699	612,124	542,057
Solid	23,393	16,201	114,854	86,044
Lime-soda process:				
Liquid[5]	60,165	65,750	315,580	317,993
Solid	19,109	20,651	101,321	101,255
Sodium phosphate:				
Monobasic	1,060	1,174	3,932	5,878
Dibasic	5,756	7,210	33,973	31,977
Tribasic	5,504	6,721	32,849	34,244
Meta	2,837	2,490	14,598	11,438
Tetra	5,205	4,011	26,419	20,446
Sodium silicate, anhydrous	33,588	39,726	208,682	207,928
Sodium sulphate:				
Anhydrous	12,876	10,701	67,446	58,141
Glauber's salt[6]	15,828	17,018	81,676	77,303
Salt cake, crude, commercial[6]	57,682	57,484	266,957	246,688
Sulphuric acid:[6, 7]				
Chamber	262,200	275,155	1,360,091	1,427,697
Contact, new	613,646	567,426	2,989,128	2,748,626
Zinc yellow, (zinc chromate) (C.P.)	413	258	1,713	1,223

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid materials, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Synthetic Organic Chemicals

April 1948, April 1947 and Four-Month Totals for 1948 and 1947

	April 1948	April 1947	Total, Four Months 1948	Total, Four Months 1947
Acetanilid	343,984	623,349	1,562,234	2,793,91
Acetic acid:				
Synthetic[1]	31,285,949	28,411,645	129,162,632	121,557,795
Recovered	137,955,446	125,368,376	549,664,959	480,484,562
Natural[2]	1,958,270	1,963,872	8,498,995	8,258,869
Acetic anhydride[3]	60,102,859	53,085,609	245,835,288	202,111,724
Acetone	38,478,433	28,491,656	148,532,255	118,391,318
Acetylsalicylic acid	1,061,005	1,042,728	3,078,690	3,823,606

(Continued on page 307)

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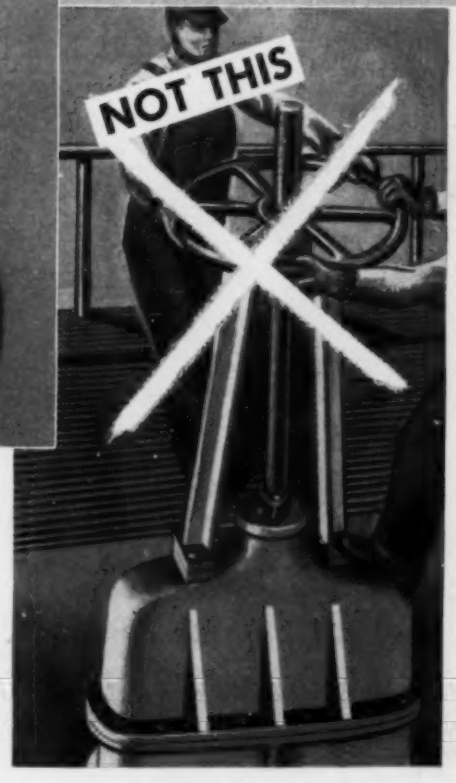
INCREASED PRODUCTION 57%

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THIS IS AN ACTUAL CASE HISTORY INVOLVING 116 LIMITORQUES

A prominent process industry manufacturer redesigned, several times, a special hand operated valve, endeavoring to secure positive shut-off—this in order to avoid contamination of the product manufactured, and also endeavor to increase the yield—but their efforts met with no success. Our engineers were called in, and LimiTorque Valve Control was applied and operated by a momentary contact Push-Button Station. The result was that yield immediately jumped from 72% of anticipated to 113%—or an increase of 57%— and all this was accomplished by the application of LimiTorque Controls. Further, labor costs of two men on a hand wheel operating valve, for twelve minutes at a time, was reduced to one-quarter of a second through push-button actuation on a LimiTorque Valve Control. It is also interesting that the "controlled positive positioning" (through the torque-seating mechanism of the LimiTorque) coupled with "position indicating lights" in the Push-Button Station, made this possible.





New 96 page catalog on LimiTorque Valve Controls will be sent upon request. When writing, please use your business letterhead.

The "LimiTorque" (at left) is for valves working at low to medium temperatures, low to high pressures, and normal speed of operation.

This Unit is mounted on top of valve yoke . . . no extra gears, nuts or bearings required. Stem nut is inside and furnished with Unit. All clutches and connecting sleeves are eliminated.

LimiTorque is designed for plug, cock, gate and globe valves . . . Entire Unit can be lifted off valve yoke, by removing flange bolts, without disturbing wiring.

A special high starting torque motor, reduction gears, limit switches, all in one weatherproof assembly—and all electrical connections are made to one terminal board, easily accessible by removal of watertight cover. A handwheel is provided for manual operation and does not revolve during motor operation. During hand operation motor is mechanically disengaged. LimiTorque is always operative electrically. No danger to operator should he be turning handwheel when motor is started, since automatic clutch disengages handwheel instantly, without shock. Declutch lever changes from motor to hand operation. The LimiTorque "hammerblow" device allows motor to reach full speed before load is engaged. This imparts the "hammerblow" necessary to unseat sticking valve.

Torque seating switch insures tight valve closure without strain on valve parts. Protection from damage due to a foreign object obstructing closing is provided, because motor is shut off by thrust exerted on valve disc. Valve is protected during entire closing operation.

Philadelphia Gear Works, INC.

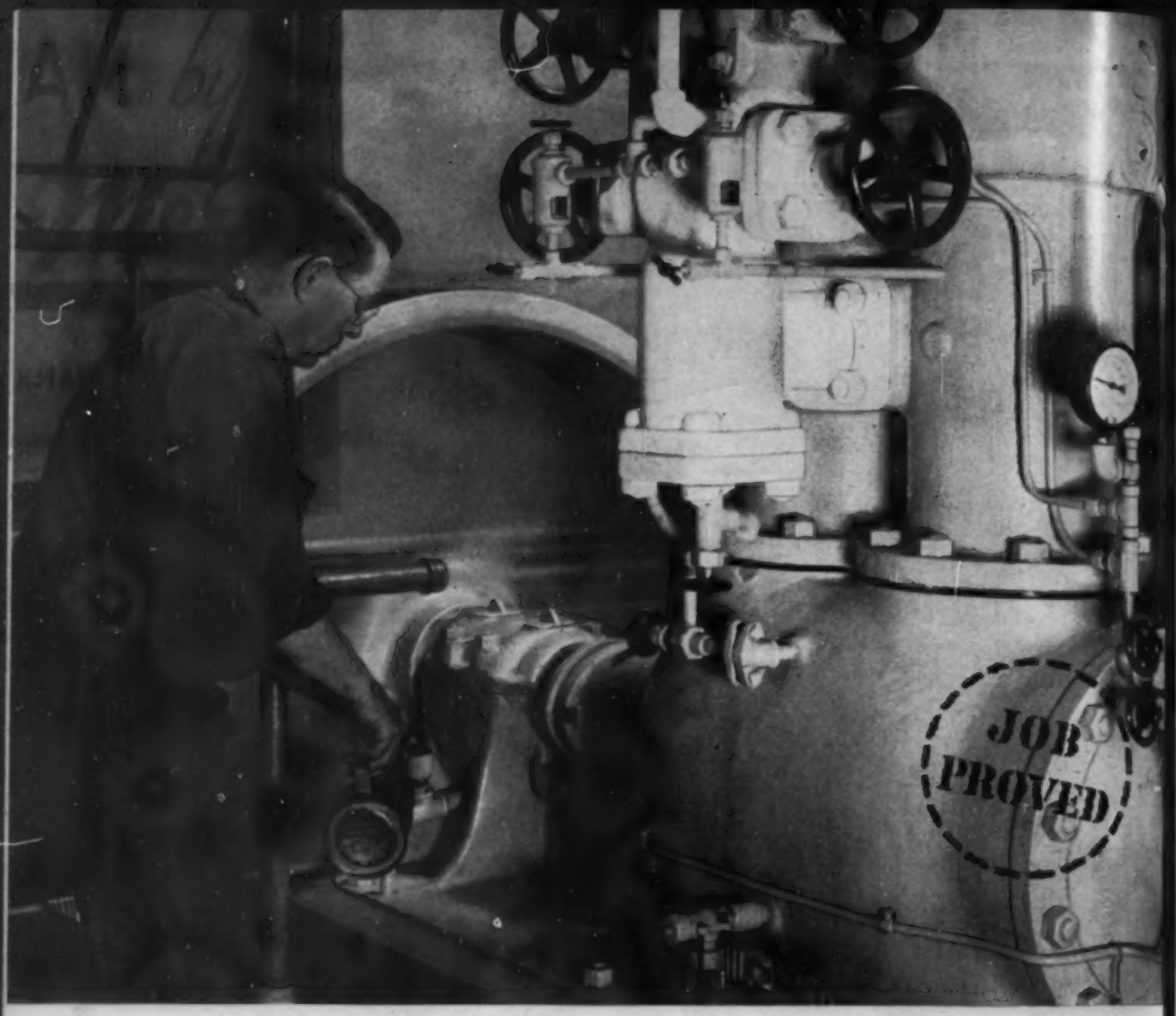


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Trouble with sticking valves and hard carbon has been largely eliminated. Main bearings last longer. Oil costs are substantially lower.

These are typical of results wherever Sun refrigeration oils are used for air-conditioning and refrigeration equipment in industrial plants, frozen food lockers, warehouses, theaters, office buildings, restaurants, and other modern installations.

"Job Proved" Sun oils are first choice of refrigeration engineers. Manufacturers of refrigeration equipment probably use more Sun refrigeration oils than the total of all others.

Sun refrigeration oils are available in six different viscosities. They are characterized by exceptionally low pour points, and by wax separation points many degrees lower than industry requirements. They do not react with Freon or other modern refrigerants. For a copy of the 52-page illustrated Bulletin "Lubrication of Refrigeration and Air-Conditioning Equipment," write Department CE 8

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SUNOCO

U. S. Production of Synthetic Organic Chemicals (Cont. from page 304)

	April 1948	April 1947	Total, Four Months 1948	Total, Four Months 1947
Aniline	8,970,426	9,319,482	35,371,458	35,954,057
5-Ethyl-5-phenylbarbituric acid and salts, phenobarbital	44,354	49,254	151,744	140,755
Benzene:				
Motor grade:				
Tar distillers[4]	.....	.....	.....	.....
Coke oven operators[6]	618,389	1,478,552	2,519,822	6,913,093
All other grades:				
Tar distillers[4]	981,687	.....	13,426,223	.....
Coke oven operators[6]	10,423,913	12,403,206	48,663,955	48,938,641
Butyl alcohol, primary, normal	11,022,463	13,473,462	42,688,043	46,701,018
Carbon bisulphide	.....	27,672,298	.....	113,786,680
Carbon tetrachloride	18,416,603	14,456,312	72,122,845	65,715,653
Chlorobenzene, mono	24,941,890	23,388,856	108,428,196	96,656,704
Creosote oil:				
Tar distillers[4]	9,476,047	10,667,247	27,789,139	44,340,703
Coke oven operators[6]	3,009,204	3,604,121	13,005,680	13,245,155
Cresols, meta-para[7]	803,279	417,867	3,900,101	1,781,569
Cresols, ortho-meta-para[7]	583,072	1,079,016	2,506,568	3,112,098
Cresylic acid, refined[4, 10]	1,580,165	2,435,860	8,453,863	8,905,817
Dibutyl phthalate	1,166,424	1,925,313	5,975,456	7,635,333
Dichlorodiphenyltrichloroethane (DDT)	1,891,075	4,397,583	8,449,866	16,710,297
Ethyl acetate (85 percent)	5,422,126	5,983,662	22,244,558	31,154,910
Ethylene glycol	28,360,533	15,442,681	103,013,830	52,783,261
Ethyl ether	2,988,092	3,371,535	10,936,759	14,396,198
Formaldehyde (37 percent by wt.)	54,479,472	45,270,852	219,119,037	178,912,257
Hexachlorocyclohexane	1,665,514	324,477	5,900,457	957,904
Methanol, natural[8]	1,421,431	1,505,607	5,542,049	5,488,651
Methanol, synthetic	69,645,746	41,210,066	261,612,728	179,432,732
Naphthalene:				
Tar distillers, less than 79°C	15,148,292	.....	66,632,627	.....
Tar distillers, 79°C. and over	9,481,434	8,854,534	36,137,711	33,534,662
Coke-oven operators, less than 79°C	7,151,936	9,099,719	32,816,067	30,129,108
Penicillin and salts	6,946,351	2,676,255	28,437,265	11,662,663
Phenol	23,245,576	19,530,745	99,805,435	75,243,143
Phthalic anhydride	13,071,537	9,604,982	51,634,184	43,828,969
Styrene, government and private plants	32,531,701	20,329,648	119,707,962	112,438,745
Toluene:				
Coke-oven operators	1,959,596	2,423,432	9,148,651	8,906,425
All other[9]	2,966,550	2,281,156	10,155,605	10,922,562
Xylene, crude	5,080,026	3,959,148	19,283,754	17,045,140

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [2]Excludes the statistics on recovered acid. [5]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

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NEW CONSTRUCTION

	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	$125,000	$2,081,000
Middle Atlantic	$695,000	$650,000	7,361,000	49,763,000
South	1,000,000	68,000	78,353,000	66,933,000
Middle West	.....	.....	12,950,000	35,388,000
West of Mississippi	20,807,000	7,710,000	154,138,000	63,551,000
Far West	500,000	70,000	13,650,000	30,107,000
Canada	52,070,000	2,360,000	89,750,000	35,805,000
Total	$75,072,000	$10,858,000	$356,327,000	$283,628,000

Proposed Work

Fla., Flagler Beach—Lehigh Portland Cement Co., Allentown, Pa., A. K. Cawley, Secy., has acquired a 1,500 acre site north of Flagler Beach on Inland Waterway, and plans to construct a plant. Estimated cost $1,000,000.

Md., White Oak—U. S. Navy Dept., Public Works Officer, Naval Gun Factory, Wash., D. C., plans to construct explosives research facilities at Naval Ordnance Laboratory, here. Estimated cost $695,000.

Tex., Chocolate Bayou—Phillips Petroleum Co., City Natl. Bank Bldg., Houston, plans to construct a gasoline plant here. Estimated cost $4,500,000.

Tex., Dallas—Core Laboratories, Inc., W. H. Davison, Pres., 2151 Fort Worth Ave., plans to construct a laboratory. Estimated cost $250,000.

Tex., Houston—City, M. H. Westerman, Secy., plans to construct a fertilizer plant at North Side treatment plant. Greeley & Hansen, 2405 San Jacinto St., Engrs. Estimated cost $712,000 (exclusive of $588,000 for equipment).

Tex., Marshall—Marshall Brick Co. plans to reconstruct its brick manufacturing plant here. Estimated cost $175,000.

Tex., McCamey—Slick Oil Co. and Associated Companies (Urshel Co. and Plymouth Co.) Milam Bldg., San Antonio, plans to construct a recycling plant here. Estimated cost $4,000,000.

Tex., Realitos—B. C. Graham and Cam Corp., San Diego, plan to construct a pressure maintenance plant in the Cam Field. Estimated cost $125,000.

Tex., Seeligson—(Alice P. O.)—Humble Oil & Refining Co., 1216 Main St., Houston, plans to construct a gas injection plant; also a gasoline refinery out of various plant units. Estimated cost $1,336,000 and $8,209,000 respectively.

Tex., Sweeney—Phillips Petroleum Co., City Natl. Bank Bldg., Houston, plans to improve and enlarge its gasoline plant. Estimated cost $1,500,000.

Wash., Anacortes—Anacortes Veneer Corp. plans to construct a 100x200 ft. hardboard plant. Estimated cost $500,000.

Alta., Red Deer—Cellulose Engineers, Inc., 71 Columbia St., Seattle, Wash., plans to construct a pulp mill. Estimated cost $5,000,000.

N. B. Edmundsen—Fraser Companies, New Castle, plan to construct a bleaching plant. Estimated cost $500,000.

N. B., St. John—Maritime Pulp & Paper Corp., Loyalist Bldg., Fredericton, N. B., is having plans prepared for a 750 ton per day newsprint mill and a 250 ton per day bleached craft mill. Stadler, Hunter & Co., 117 St. Catherine St., W., Montreal, Que., Engr. Estimated cost between $45,000,000 and $50,000,000.

N. B., Weldon—Atlantic Chemicals Co., Ltd., Weldon, plans to construct a plant for the manufacture of superphosphates and cement. Estimated cost $4,000,000.

Ont., Brantford—T. R. Walsh Seed Oil products, 135 Ivy Ave., Toronto, Ont., plans to construct a 2 story plant. Estimated cost $70,000.

Contracts Awarded

Calif., Oleum—Union Oil Co., Oleum, has awarded the contract for improvements to its compounding and packaging plant to C. Norman Peterson, 2832 9th St., Berkeley. Estimated cost will exceed $70,000.

Conn., New Haven—New Haven Pulp & Board Co., 259 East St., has awarded the contract for a 4-story, 60x195 ft. factory to Bethlehem Steel Co., Bethlehem, Pa., and Blakeslee & Sons, Inc., 58 Waverly St. Estimated cost $325,000.

Ga., Savannah—Pittsburgh Plate Glass Co., c/o Olaf Otto, contractor, 413 East Bay St., will construct a warehouse. Estimated cost $68,000.

Md., Baltimore—Standard Wholesale Phosphate Co., Mercantile Trust Bldg., has awarded the contract for a rock storage, grinding and hot den building to Whiting-Turner Construction Co., 305 National Marine Bank Bldg. Estimated cost $150,000.

Mo., Cape Girardeau—Shell Oil Co., 45 South Louisiana St., has awarded the contract for a bulk oil depot to include office and warehouse facilities, to R. B. Potashnick, Cape Girardeau. Estimated cost $90,000.

N. J., Dover—Hercules Powder Co., Wilmington, Del., has awarded the contract for nitrator buildings at Kenvil Plant to William B. Huxster, Dover Hills, Dover. Estimated cost between $150,000 and $200,000.

Tex., Cleburne—Limestone Products, Inc., Cleburne, will construct a limestone processing plant. Work will be done with own forces. Estimated cost $325,000.

Tex., Fort Worth—American Cyanamid Co., W. L. Spalding, Mgr., has awarded the contract for an addition to its chemical plant here to Morgan Bell Associates, Lake Charles, La. Estimated cost $115,000.

Tex., Fort Worth—Cook Paint & Varnish Co., 5th and Throckmorton Sts., has awarded the contract for a warehouse to B. B. Adams, Inc., Fort Worth Natl. Bank Bldg., at $129,579.

Tex., Houston—McCullum Laboratories, Inc., 607 Oakley St., has awarded the contract for a laboratory to E. Lee Bond, 607 Oakley St., at $96,972.

Tex., Houston—Southern Acid & Chemical Co., 7621 Wallisville Rd., has awarded the contract for a chemical plant to Leonard Construction Co., 3700 South Wabash Ave., Chicago. Estimated cost $5,000,000.

Tex., Houston—Sun Oil Co., M Esperson Bldg., has awarded the contract for a gas plant to extract liquid hydrocarbon from flare gas; 10,000,000 cu. ft. gas daily; 30,000 gal. liquid hydrocarbons daily, near Silver, to J. F. Prichard Co., Fidelity Bldg., Kansas City, Mo. Estimated cost $1,250,000.

Tex., Mt. Pleasant—Talco Asphalt & Refining Division of American Liberty Oil Co., will reconstruct a portion of its refinery. Work will be done by owners. Estimated cost $78,000.

Tex., Sunray—Shamrock Oil & Gas Co., Shamrock, plans to enlarge its gasoline plant here. Work will be done with own forces. Estimated cost $450,000.

Tex., Tyler—McMurrey Refining Co., Tyler, will construct an additional polymerization unit to refinery. Work will be done by owners. Estimated cost $175,000.

Ont., Hamilton—Procter & Gamble Co. of Canada, Ltd., Burlington St., E., has awarded the contract for enlarging boiler house to provide greater production facilities at plant to Provo Construction Co., Ltd., P. O. Box 67. Estimated cost $1,860,000.

Que., Hull—Canada Cement, Ltd., Montreal, has awarded the contract for a rock crushing plant to Doran Construction Co., Ltd., South Concord St., Ottawa, Ont. Estimated cost $500,000.